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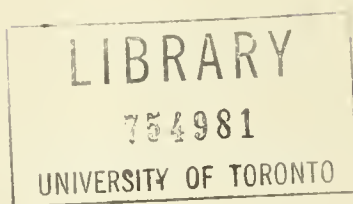
THE ST. LAWRENCE WATERWAY

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PREFACE

It is hardly necessary for me to state that efficient transportation is the very life blood of our country. The inhabited part of Canada may be likened to a long ribbon of territory, thousands of miles long and but a few hundred miles wide.

To keep Canada an unbroken entity economically as well as politically, the Intercolonial and Canadian Pacific Railways were built. But long before our West had an economic existence, Upper and Lower Canada had their own transportation problems. Habitation being along the water routes, and the existing roads being frequently inaccessible, the early dwellers of the two Canadas depended on water transportation for their commerce and communication.

After the expansion of the West both railway and water transportation progressed rapidly in Canada.

Too great optimism in the past has caused us to over-expand our railroad facilities. This has involved us into a huge railroad debt that we are bravely trying to liquidate. The Great War has further forced us to bear a further debt of unprecedented magnitude.

For a country like the United States, such debts may be considered as nothing more than "spending money", but for us it is something that we must seriously consider. Anything, therefore, that leads to increase our public debt we must look



at askance.

Now it is proposed that we expand our water transportation facilities on the Great Lakes. This study, therefore, has been undertaken with the object of better acquainting ourselves with the facts and principles involved by such a proposal.

My thanks are due to Professor Jackman's kind suggestions.

D. A. Diamond

CHAPTER 1

THE ST. LAWRENCE WATERWAY IN THE PAST

The St. Lawrence Waterway refers to that large expanse of inland waters on the North American continent that penetrates from the Atlantic Ocean into the heart of Canada and the United States. It consists of Lake Superior, Michigan, Huron, St. Clair, Erie and Ontario, the St. Mary's River, connecting Lakes Superior and Huron, River St. Clair, linking Lakes Huron and St. Clair, the Detroit River, joining Lakes St. Clair and Erie, Niagara River, uniting Lakes Erie and Ontario and the St. Lawrence River proper which flows out into the Atlantic ocean. All of these bodies of water, with the exception of the St. Lawrence River proper which from Cornwall up is totally within Canada, form the eastern half of the boundary between our country and the United States.

When the French first arrived in Canada, they found these different bodies of water navigated by the Aborigines, in their bark canoes. These Indians loaded with furs came down the navigable rivers to the French posts and exchanged them for trinkets, rum and fire-arms brought over from Europe. I need not here go into details: suffice it to say that this trade prospered and expanded. As it did, so new and improved routes of travel became necessary. This need was first overcome by increasing the number of canoes and as the rivers were

more or less navigable, increased or decreased the size of the canoes. This trade largely centred around the St. Lawrence River and its tributaries. But as the trade in furs assumed larger proportions and expanded far into the interior, the transportation problem became acute. The seriousness of the situation could be better realized when we know that the whole country depended for its existence upon the fur trade. The heaviest charge of all was not the purchasing of the furs from the natives but the cost of bringing supplies into the inland depots and carrying back the furs. With the fall of French Canada this trade fell and prospered in English hands. But the difficulties which faced the French still taunted their successors.

The canals of Canada were constructed for military purposes as a direct result of the American revolution; but they were also used for commerce. They were built upon the St. Lawrence River around the upper and lower three rapids between Lake St. Francis and Lake St. Louis at the Cascades. They were built sometime between 1779 and 1783. The locks were of stone less than forty feet long and only six feet wide and with thirty inches of water, which was sufficient, for the only boat then in use besides the canoe, the bateau. One writer claims that the bateau had the dimensions of the Venetian gondola. It was a flat bottomed, sharp pointed skiff, had a beam, five and a half feet and a length of thirty-five feet. When these canals were built the yearly traffic on the Upper St. Lawrence

to Carleton Island amounted to from 240 - 320 bateaux. A toll was charged for this service. The canals remained in this condition until 1800 when the traffic became so congested that improvements were undertaken. These early canals were enlarged several times.

(After the War of 1812, larger boats were introduced on the St. Lawrence. Their capacity was about thirty-five tons. In order to accommodate these larger vessels the canals were further enlarged.

The first canal and lock between Lake Huron and Lake Superior was built by the North-West Fur Company. This corporation, if it may be called such, cut a roadway forty-five feet wide across the portage on the Canadian side of the Sault Ste. Marie and opened a canal of more than three hundred feet in length with a lock which raised the water nine feet. It was completed in 1798. But in July of 1814 this post was pillaged by the Americans and the canal, whose structure was wooden, burned down.

A brief history of the existing canals on the Great Lakes and St. Lawrence River, may not be amiss in order to familiarize us with the subject at hand. The Lachine canal was the first to be built. The project was to be undertaken by the Government of Lower Canada after the War of 1812. But nothing materialized though money was voted for the construction of the canal. A company was organized in 1819 but it similarly failed. Finally the government undertook

and completed the work in 1825. The next canal in order of time of construction, though not of position upon the main line of the St. Lawrence navigation, was the Welland Canal. This canal, unlike the Lachine canal, was undertaken by a joint-stock company in 1824. But after the union of the Canadas in 1841 the government purchased this canal and enlarged it. The Cornwall canal, the third in point of time, was started by the government in 1834 and was completed in 1843. The fourth canal, the Beauharnois, which is entirely in Lower Canada and the only one upon the South side of the St. Lawrence, was commenced in 1842 and was completed three years later. The three smaller canals, located above Cornwall at Farrans Point, "Rapide Plat" and the "Galops" and known collectively as the Williamsburgh canals, were finished in 1847. Mr. J. C. Keefer tells us: "through the improvement of all these canals periodically, by the government, a boat an hundred and forty feet long, twenty-six feet beam and nine feet draught could for the first time in 1848 pass from Montreal to Chicago". About this time the deepening of the St. Pere or Montreal channel was begun in 1850, not by the government but by the municipality. The work was entrusted to the Montreal Harbor Commission which by the time of Confederation had dredged the channel to a depth of twenty feet. When a depth of over twenty-seven feet was attained in 1858, dredging operations were taken over

by the Federal Government. The deepening of this channel made Montreal the most inland ocean port in the world and at the same time, supplanted Quebec as Canada's largest port. A regular liner service was inaugurated between Montreal and England in 1853.

The next canal built was the St. Mary's River, in 1855 by the State of Michigan. This canal was opposite to the old destroyed Canadian canal. Whereas all the other canals were built by Canada, here we find a departure, so it seems, from the general rule, for this canal was American. The question of the improvement of inland navigation was incessantly considered by Canadian statesmen. A commission, appointed in 1870 reported the next year, advising a uniform scale of navigation for the St. Lawrence and Welland canals. Parliament five years later ordered the already enlarged canals to be deepened to fourteen feet. In arriving at lock dimensions and draft of water the commission of 1870 seem to have been guided by the existing size of the majority of the vessels on the Great Lakes as well as by the depth of water in the harbours. They were all agreed that any canal of more than 300 feet in length and 14 feet draught would be unwise. This commission also recommended that the destroyed Canadian canal at Sault Ste. Marie be replaced. But work on this project was not begun until 1892. Its size was greater than that originally recommended by the commission. It had

a length of one and one eighth miles, a width of one hundred and fifty feet and draught of eighteen and one third feet. In 1888 the United States government started a new canal at Sault Ste. Marie, eight hundred feet in length, one hundred in width and twenty-two feet draught. There are now two canals on the American side, both improved to a depth of twenty-four and a half feet. In addition, the St. Mary's River was improved and dredged to a twenty-one foot depth at low water with a width varying from 300 - 1000 feet. All this work was done by the American government. About 1907 the American government also began the dredging of the St. Clair and Detroit Rivers, so that channels from twenty to twenty-three feet in depth at low water and two thousand feet wide exist in the former and an eight hundred foot width and twenty two foot depth in the latter. Lake St. Clair, the intervening Lake, was also dredged by the American government to a depth of twenty feet. The Detroit River has two channels, the Amherhurst six hundred wide by twenty-two used for up bound traffic and the Livingston channel, eight hundred by twenty-two for south-bound traffic. Both channels are over thirteen miles long, six miles of which run through Canada. Both structures are completely maintained by U.S.

The next canal undertaken was the Soutauges built right opposite the Beauharnois canal on the north side of the St. Lawrence. For military reasons this canal was started by the Canadian government in 1892. It has completely supplanted the

older canal, by virtue of its modern equipment.

The most recent development in canal construction is the building of the new Welland ship canal. It was commenced in 1913 by the Dominion Government. The purpose of this new canal is to permit the large vessels plying the upper lakes to descent down Lake Ontario. The line of the proposed structure which will be completed about 1930, follows the course of the present canal from Port Colborne to Allanbury about half way across the Niagara peninsula. Thence an entirely new channel is provided and the canal will enter Lake Ontario at Port Willer, three miles east of the present terminus of the canal.

To show the wisdom in the construction of these canals, it would be appropriate here to give a resume of our early trade along the St. Lawrence. {From 1768 to 1783 inclusive the entries at Quebec which was the metropolis and great seaport of Canada averaged only twenty-four annually. The average tonnage of the vessels was sixty-four tons, and the largest ninety-seven. The average yearly dealings during the period were twenty-six. These vessels brought in the bulk of the rum used in the country and a large part of the coffee, sugar and molasses. The last two came mainly from the West Indies. Considerable quantities of pease, lumber, wheat, biscuit and flour were exported between 1770 - 1775. In 1802 Canada exported over one million bushels of wheat, twenty-eight thousand barrels of flour and other products in

addition to furs. Great Britain was Canada's chief port for potash, fish oil and lumber. The West Indian trade, and foreign trade exclusive of the States was small and confined chiefly to codfish, salmon, boards, planks, and wheat. She imported from these, sugar, molasses and salt; while tea and wine was usually brought from England.

The influx of the Loyalists had begun to give Ontario a civilized appearance. The prosperity of this province had apparently a great deal to do with the development of the St. Lawrence route. About 1800 we find that there were few roads if any and those were mere Indian trails. It was of necessity therefore that Upper Canada had to depend largely upon the lakes and the St. Lawrence River for her commerce. Because of this peculiar situation, water transportation developed considerably along this highway.]

In the early years of the 19th century there was not a lighthouse on the Great Lakes. The first lighthouse on the St. Lawrence was erected in 1809 at Green Island. By 1866 there were one hundred and thirty-one. At this time with the introduction of steam, a transformation in travel and commerce took place. [By 1825 the population of both provinces had almost doubled. With this increase, trade prospered. The attention of the governments were then attracted to the improvement of the St. Lawrence River between Montreal and Lake Ontario. Between these two points were the main obstacles to the free navigation of the river. The St.

Lawrence canals depended mainly on Canadian trade for their success but the Welland canal was largely dependent upon American traffic.]

In 1846 the shipping on the Great Lakes was over one thousand with a tonnage of more than half a million. There were seventy-three ships operated by steam. [In 1854 two hundred and fifty-eight ocean vessels arrived at Montreal with a tonnage of nearly seventy one thousand tons and river vessels in the port were more than three thousand with a tonnage of over two hundred thousand.] [In 1856, ocean boats of two hundred and five thousand tons arrived at Montreal and over four thousand river boats with a tonnage of over four hundred thousand. We find that Montreal first passed the million ton mark in 1892. The trade of Canada jumped from relatively insignificant figures at the beginning of the 19th century to \$127,876,000 in 1869. We can thus observe for ourselves how substantial is the assertion that the canals were to early Canada, what the railways were to confederation.]

In order to better acquaint ourselves with the magnitude of this naturally glorious waterway, it would be well to give a somewhat detailed description of the navigation improvements on it made necessary by the numerous cascades and rapids. From the Atlantic and the Straits of Belle Isle to Duluth on the West shore of Lake Superior, there is a distance of two thousand three hundred and eighty-four statute miles. Montreal at the head of the present ocean navigation is nine

hundred and eighty-six miles from Belle Isle. The river is salt as far as St. Thomas, 766 miles from the ocean, while the tides are regular as high as Three Rivers. This great waterway with its lakes and connecting rivers has an area of 98,000 square miles, a coast of 2112 miles and a basin area of 330,000 square miles. From the ocean to Quebec city the river varies in width from 70 to 10 miles with a proportionate depth. It is, however, dotted with reefs and islands and subject to fluctuating currents and summer fogs, which make it obligatory to have the present efficient system of lighthouses, sirens and buoys. From Quebec to Montreal the river is seldom less than two miles in width: its depth is never less than thirty feet. The current of this gigantic river is gently but in its descent of 235 feet from Lake Ontario to Montreal, a distance of 182 miles, it traverses a series of steps creating between the above points about 45 miles of rapids and falls. As it has just been mentioned, from Father point to Montreal, a thirty-foot channel has been completed with a width of 450 feet in the straight portions of the river and 650 to 750 in the bends. The deepening of this channel to 35 feet was begun in 1904.

[As we ascent the St. Lawrence, the first canal we come upon is the Lachine. It extends from Montreal to the town of Lachine. This canal overcomes the St. Louise Rapids. It is 8½ miles long with an average width of 150 feet. There are five locks, 270'X 45, at two of which the depth on the sills

is 18 feet and on the other three 84 feet. The canal consists of one channel with two distinct systems of locks, the old and the enlarged. There are two lock entrances at each end.

The old Beauharnois canal having become obsolete, the next canal is the Soulanges. From the head of the Lachine canal to the foot of the Soulanges canal there is a navigable stretch of 16 miles in the St. Lawrence River and Lake St. Louise. This canal is 14 miles long, 164 feet wide at the surface with 15 feet of water on the sills. It has one guard lock and four lift locks 280'X 45'. This canal extends from Coteau Landing to Cascades Point. It overcomes the Coteau Rapids, Adar Rapids and the Cascades Rapids.

From the head of the Soulanges canal to the foot of the Cornwall canal which is the third canal going up stream, there is a navigable stretch of 31 miles, through Lake St. Francis. This canal extends from Dickinson's Landing to the town of Cornwall. It avoids the Long Sault Rapids. It is 11 miles long and 54 feet wide at the surface. It has one guard gate and six locks 270 X 45. The depth of the water is 14 feet on the sills.

Next we reach the so-called Williamsbury canals, the first of which is Farrans Point Canal. From the head of the Cornwall canal to the foot of Farran's Point canal there is 5 miles of navigable river. This canal is $1\frac{1}{4}$ miles long and 154 feet wide at the surface with a 14 feet depth on the

sills of lock which is 800 X 50. The rapids here are not difficult to overcome for we find that while ascending vessels use the canal, descending ones run the rapids.

From the head of the Farran's Point canal to the foot of the Rapid Plat canal which is the next in order, there is a navigable distance of $9\frac{1}{4}$ miles. This canal, like the previous one, was constructed to enable vessels to ascend the river. Descending vessels run the rapids here with safety. The Rapid Plat canal is $3\frac{2}{3}$ miles long and 152 feet wide at the surface with 14 feet of water on the sills. It has two locks 270 X 45.

From the head of the Rapid Plat canal to the foot of the Galop canal, the last canal on the St. Lawrence river proper, as we ascend, there is a navigable stretch of water $4\frac{1}{4}$ miles long. At Galop island the uppermost rapids of the St. Lawrence River are encountered. In order to facilitate transportation here, this canal, like the rest, was constructed by the federal government. This canal is $7\frac{1}{3}$ miles long and 144 feet wide at the surface. The depth is 14 feet on the sills. It has two lift locks 303 X 45 and 800 X 50. There is one guard lock at the head of the canal 270 X 45.

Between Galop island and Lake Ontario, a distance of 68 miles, there is a channel 30 feet or more in depth with a minimum width of 500 feet. In our ascent from Father Point to Lake Ontario we have climbed about 260 feet, 235 of which

is concentrated from Montreal to Lake Ontario. The above-mentioned six canals have enabled us to overcome this difficulty.

Thus from Father Point, which marks the transition into the Gulf of St. Lawrence southwest to Lake Ontario, the distance along the St. Lawrence River is 533 miles. The entire river from the Atlantic to the town of Cornwall is almost wholly within the province of Quebec. The most south westerly part here is also in Ontario. The remainder from Cornwall approximately speaking, to Lake Ontario is an international river, running through the State of New York and the Province of Ontario. It is about 116 miles in length.

Our journey next takes us across the full length of Lake Ontario from its mouth at Tibbetts point to Port Dalhousie, a distance of 156.25 miles. The area of this Lake is 7,100 square miles. Its great depth prevents storms that are so common on Lake Erie. Here we have to overcome a rise of 326 feet, of which 165 is concentrated at Niagara Falls proper. This is overcome by the existing Welland canal which extends from Port Dalhousie on Lake Ontario to Port Colborne on Lake Erie. It is about $26\frac{1}{4}$ miles long and has twenty-five lift locks, each 270'X 45'X 14' on the sills. In order to provide accommodations for larger vessels, operations were begun in 1913 for the construction of a new ship canal between the above-mentioned lakes. The total length of the new canal is 25 miles. The difference in elevation between the two lakes

will be overcome by seven lift locks each having a lift of about 47 feet. The locks will be 800 feet long, 80 feet wide at the surface with 30 feet of water over the sills, at extreme low stages in the lakes. For the present, the canal reaches will be excavated to a depth of 25 feet only but all structures will be sunk to a 30-foot depth so that the canal can be deepened at any future time by simply dredging out the reaches. Both of these structures are well within Canadian territory in the province of Ontario. But on the south side in the State of New York from Buffalo to Albany there is the so-called Erie barge canal. It is entirely American and has a depth of about 11 feet. The purpose of this canal was to divert the traffic from its natural course along the St. Lawrence canals down to New York. It was started in 1908. So far it has failed in its object after vast expenditures by the State of New York.

From Port Colborne, on Lake Erie to the mouth of the Detroit river, there is a distance of 219 miles. Lake Erie has an area of over 10,000 square miles but is considerably shallower than Lake Ontario and consequently very stormy at times. The whole of this expanse of water is navigable. Its average depth is about 57 feet.

From Lake Erie to the mouth of Lake St. Clair is the Detroit River, 31.6 miles long. Here considerable dredging has been done by the American government. There is an artificial channel 16.25 miles long. It has a minimum width of

600 feet and a minimum depth of 42 feet. From this river to the mouth of the St. Clair River is Lake St. Clair. At the mouth of the latter river is the St. Clair Flats canal. From the head of the Detroit River to the head of this canal is a distance of 18 miles. At the head of the Detroit River is the Grosse Point channel. There are altogether 18.87 miles of artificial channels in Lake St. Clair. The depth is at least 21 feet. It is a marshy shallow lake with turbulent waters. It is 25 miles long and has an area of 445 square miles. Between the head of this lake and the southern extremity of Lake Huron is the St. Clair River, 40 miles in length. It has about 15 miles of artificial channels, some of which are on the Canadian side. There are two dredged cuts 300 X 21 that extend 17,460 feet into Lake St. Clair. Thus from the St. Clair Flats canal to the foot of Lake Huron the distance is about 42 miles. It may be mentioned here that 80% of the structures on the connecting waterways between Lakes Huron and Erie are on the American side. The entire cost of construction and maintenance, however, is undertaken by the American government.

Between Lake Huron and Lake St. Clair we have a fall of about 5 feet and a descent of about 3 feet between the latter lake and Lake Erie. But this descent or ascent depending on which ever way one views it, is gradual. No locks are therefore needed, but merely channels of sufficient depth. Thus from Lake Erie to Lake Huron there is a gradual

ascent of about 8 feet.

We now come upon the second largest of the Great Lakes, Lake Huron. It has an area of 23,200 square miles. This lake is the second deepest. From the head of St. Clair River to Point Detour by the St. Mary's River there is a distance of 216 miles. Near this point, vessels may either go up the St. Mary's river and through to Lake Superior or down Lake Michigan which is the same level as Lake Huron, and is entirely in American territory. It has almost the same area as Lake Huron but it is not as deep. If we desire to ascent the St. Mary's river to enter Lake Superior we are confronted with a rise of 22 feet, which is the difference in the levels between Lake Huron and Superior. This obstacle is nearly all overcome by the four locks at Sault Marie, three of which are American and situated on that side. The length of this connecting stream is about 64 miles. In addition to the locks the river has been dredged to a depth of 21 feet. In places we find double channels which have a width of 300 feet, while in others there are single channels with a width of 600 feet. The Canadian lock and one of the American locks have a depth each of 18 feet and $18\frac{1}{2}$ respectively while the other two American locks have a depth of $24\frac{1}{2}$ feet on the sills. The American canals are used mostly going down stream when the vessels are heavily laden. The Canadian canal being of less than the channel depth is used by boats coming

up stream when they are not heavy nor draw more than 18 feet of water. The channel improvements above the Soo are small. Below Sault Ste. Marie, the excavation is continuous for a long distance. In this river there is 22 miles of improved channel and 1.7 miles of canal, going one way. The Americans maintain this channel also.

Beyond the waters of the Soo lies Lake Superior, the largest fresh water lake in the world. It has an area of 31,800 square miles and is the deepest of the Great Lakes. One can sail from the head of the Soo to Fort William, a distance of 250 miles, without meeting any further restrictions.

[By agreement between Canada and the United States all these canals and channels from the head of the lakes down to the Gulf of St. Lawrence are toll free and open to the subjects of either country. The Americans have the same rights on our canals and channels as we have. They, in turn, accord us the same privileges on theirs.

So far nothing has been said with regard to water power development along this route. With this particular phase of the St. Lawrence waterway we shall be concerned in the next chapter.

CHAPTER 2

EXISTING POWER DEVELOPMENTS

Canada is the second largest power producer per head of population in the world: Norway is first and the United States fifth. Our country has a known potential power of 41,700,000 h.p. Canada produced in 1926 over 4,500,000 h.p. We need not be surprised at this when we know that the water area of Canada is estimated at 142,923 square miles and especially when many parts of this well watered country are situated at a considerable height above sea level.

We are directly concerned with the amount of power developed along the St. Lawrence waterway. This we shall proceed to ascertain immediately. Commencing at the head of the Great Lakes, the first structures for power development are found at the Soo. On the Canadian side of the river there is a power canal and a power house which use about 20,000 c.f.s. Taking 15 h.p. equal to 1 cubic foot per second, we have a total of 300,000 h.p. On the American side there is a canal $2\frac{1}{2}$ miles long inland which carries 30,000 c.f.s. to a power house about a mile below the locks. This gives another 450,000 h.p. Thus at the Soo, there is developed about 3,750,000 h.p. The next power development is down Lake Michigan where 10,000 c.f.s. are being diverted

illegally by Chicago. The greatest power development on this waterway is at Niagara Falls. Here 56,000 c.f.s. are diverted for power purposes, 36,000 of which belong to Canada. This means a total power of 1,680,000 h.p.

Coming down the St. Lawrence 20,000 c.f.s. is taken from the Cedar rapids through a canal to Massena, N.Y., where the Aluminum company of America develops power necessary for its factories. This water is diverted here capable of yielding 400,000 s.h. At these rapids the Cedar Rapids Manufacturing Power Company have a powerhouse capable of developing 180,000 h.p. but actually developing 100,000 h.p., of which at least 65,000 is exported to the United States. The Soulages plant of the Civic Investment and Industrial Company is a short distance below the Cedar plant. Power is obtained here to the extent of 15,000 h.p. by tapping the Soulages canal. The Canadian Light and Power Company has a plant on the south side of the St. Lawrence directly opposite the two last mentioned developments. It utilizes both the Coteau and Cedar rapids. The development will have an ultimate capacity of 50,000 h.p. but the present installation is only for 30,000 h.p. The St. Lawrence Power Company at Mitle Rocks utilizes 2,200 h.p. from the Long Sault rapids. There are also two small plants at Iroquois and Morrisburg developing less than 1000 h.p. each. At Lachine 17,000 h.p.

All of these power developments except that at Chicago return the diverted water back to the waterway.

The development of powerhouses, power canal and navigation improvements effect the levels of the Great Lakes. Consequently all the towns bordering these lakes are immediately effected. The situation is further complicated by the fact that this waterway is international. It is imperative, therefore, that we know the understandings that exist between Canada and the United States with regard to this waterway.

CHAPTER 3

AGREEMENTS BETWEEN CANADA AND THE UNITED STATES

WITH REGARD TO THE ST. LAWRENCE WATERWAY

Dr. O. D. Shelton informs us that as a result of a series of discussions following the Napoleonic Wars 1815, the Crimean war 1856 and the Great War 1919, and as a result of Congresses and conferences there has come to be a net work of treaties providing for the opening either to all bordering states or to practically all the great rivers of Europe, the Danube, the Rhine, etc.

The same procedure has been undergone with regard to African rivers - particularly the Congo and the Niger. This was done by the Congress of Berlin 1887-88.

Such freedom is equally true of South American rivers. The river Amazon has been free to all vessels since 1867: the river de la Plate, the Uruguay and Parana, the other large rivers of South America are similarly open to all vessels.

People have, therefore, concluded from the above that it is an accepted rule of International Law that all great international rivers are open to navigation either by the riparian states or by all. The consensus of opinion, according to Dr. O. D. Shelton, Under-Secretary for External Affairs of Canada, of international jurists is distinctly against that

interpretation. The prevailing view is that such rights of navigation in rivers in Europe, Asia, Africa and South America as exist are based not on any generally recognized principle of International Law but on special treaties and agreements.

This is particularly true as regards North America and the St. Lawrence River. Canada has never recognized the existence of any general rule of International Law which would govern the navigation of the St. Lawrence. We have always maintained that it was an affair for specific agreement with our American cousins or with any one else that might be interested.

Coming then to specific treaties with regard to the St. Lawrence River the first was that of 1783 after the war of the American independence. The boundary between the two countries was made the Forty-fifth parallel until it reached the St. Lawrence River. From there it was to follow the middle of the river. Trouble arose about 1825 when the Americans claimed that they had a God given right to navigate the St. Lawrence. This contention was denied by Great Britain. The Americans then built the Erie canal and all trouble temporarily subsided.

About 1820 trouble arose as to the meaning of the phrase middle of the river. This was settled amicably by both parties.

In the Ashburton-Webster Treaty of 1842, article 7 reads as follows: "It is further agreed that the channels in the River St. Lawrence on both sides of the Long Sault Islands

and of Barnhart Island, the channels in the River Detroit, on both sides of the Island Bois Blanc, and between that island and both the Canadian and American shores, and all the several channels and passages between the various islands lying near the junction of the River St. Clair with the lake of that name shall be equally free and open to the ships, vessels and boats of both parties."

The Reciprocity Treaty of 1854, included a clause regarding the free navigation of the St. Lawrence River and canals and of Lake Michigan. The Treaty was abolished in 1866. The Washington Treaty of 1871, provides that "the navigation of the River St. Lawrence within Canada, ascending and descending shall forever remain free and open for the purposes of commerce to the citizens of the United States, subject to any laws and regulations of Canada, not inconsistent with such privileges of free navigation." This means that from Cornwall to the sea the St. Lawrence river is open to American citizens. For the international section of the river, up to this time there was no specific treaty. Both countries assumed equal privileges but that is all. Though the treaty didn't specify that free navigation of canals was included, yet both countries did not raise any objection to the use of each others canals. In fact, business acumen told both countries to permit the use of their canals to each other on a par with their own nationals. Canals on waterways not specified by this treaty were being navigated

on terms of equality by either country, without any formal agreement but merely by an informal understanding, and a sense of goodwill.

The above treaty gave definite privileges to the Americans on the strictly national part of the St. Lawrence river. The privileges that each country was to possess in the international section of the river and on the great lakes and connecting waterways was not settled under specific treaty form until 1909. This treaty was the result of the International Waterways Commission which was formed a few years back to investigate and report on matters pertaining to this great waterway. This committee, whose powers were strictly limited, recommended and was the cause of the formation of a new and more powerful committee, the International Joint Waterways Commission. This latter body has judicial and administrative powers that its predecessor lacked. It is composed of an equal number of American and Canadian representatives, namely, three each. It derives its^{birth and} authority from the above treaty.

Something should be mentioned here of the powers of the International Joint Waterways Commission. This body is consulted and its findings put into effect when some controversy arises that affects the boundary waters between the two countries. Although, if the two governments make a particular treaty or agreement on a proposal affecting the boundary waters the commission is not invoked at all, though it may act in an

advisory capacity: or if one country undertakes certain improvements that may not affect the levels of the boundary waters but obtains the consent of the other, the joint board is not called upon.

Therefore a treaty agreement or the common consent of the two nations would entirely supersede any reference to the joint commission. But proposals that may affect the levels of such waters, either in part or as a whole, are often referred to this committee, whether such proposals come from private individuals or from the government of either country. Such cases are brought before the commission and thoroughly discussed. If it is found that with certain precautionary measures and compensatory structures a proposal for a particular undertaking on these waters would not materially affect their levels, permission is usually granted, but otherwise it is refused. A case in point is the proposal of the Michigan Northern Power Company on one side and of the Algoma Steel Company on the Canadian side to extract more water at the Soo, for power purposes; it was quite obvious that that withdrawal would affect the level of the boundary waters. The matter was therefore referred to the commission in 1913. The committee then laid down the regulations under which the diversion was to be made and suggested the appointment of an International Control Board consisting of one engineer from each side to supervise. Again, in 1916 the

United States proposed to do some dredging on its own side of the river St. Clair and to erect a submerged river across the river, part of it in Canadian waters. This proposal also affected the levels so the joint commission was invoked. Certain recommendations were made by that body which proved acceptable to both governments and have since gone into effect.

It is important to remember, however, that this joint commission is a secondary authority, the governments of both countries having precedence over it. If proposals are made that affect the boundary waters these may be settled by agreement between the two governments or by application to the commission. Usually matters that the governments feel they need not handle, are forwarded to the commission for settlement. At any time matters can be removed from the jurisdiction of the commission, if the two governments should decide to settle their disputes by treaty or agreement.

By the Boundary Waters treaty of 1909 navigation of the Great Lakes including Lake Michigan and the connecting waterways up to the national section at Cornwall, was declared open to the nationals of both countries on terms of equality. That is, either country may adopt rules and regulations governing the use of such canals and rivers lying within its own territory, but all such rules must apply alike to both countries. If tolls were charged they must be non-discriminatory.

It authorized the diversion of 55,000 c.f.s. for power purposes at Niagara Falls, of which 35,000 c.f.s. was for

Canada and permitted the diversion of 4167 c.f.s at Chicago for sanitary purposes.

A clause in the treaty specifically provides that rivers flowing into this waterway are under the control of the country from which they emanate. But if anything is committed that injures persons below they have access to the courts of the country perpetrating such an outrage.

This treaty, which as I have previously mentioned, created the International Joint Waterways Commission, may be terminated by either country giving twelve months notice to the other of its intention to do so.

The next agreement with regard to the St. Lawrence waterway between the two countries occurred in 1920. In January of that year the governments of the United States and Canada referred to the International Joint Commission questions relating to the improvement of this waterway and particularly the St. Lawrence river between Lake Ontario and Montreal, for the purpose of making it navigable for deep-draft vessels and at the same time securing the greatest beneficial use of the water for power. Each of the governments designated an engineer to co-operate in the necessary surveys.

With the co-operation of these engineers the Commission issued its report in December of the next year. Needless to say the report in its essence was favourable to the deepening of the waterway but recommended that before any final decision is reached, further study should be given to a project of such

magnitude. The International Joint Commission recognized that in addition to the economic aspects of the waterway, were its technical or engineering aspects. The commission felt that although it had exhaustively dealt with the project from its economic possibilities and gave its verdict most decidedly in the affirmative, yet it felt that there were engineering difficulties which could only be adequately considered by a body more technical than itself. The commission therefore recommended that the matter be further examined into by a new board chosen from the engineering profession representing both countries.

Following this recommendation it was agreed, in 1924, by the United States and Canada, that a joint Board of Engineers, consisting of six members, three representing Canada and three the United States, be constituted to review the plans then formulated, paying particular attention to engineering problems and to report on such additional matters that might be referred to it.

In the same year the governments of Canada and the United States each appointed a separate committee of nine members to act in an advisory capacity to their respective governments on matters pertaining to this great problem. The American committee was designated as the St. Lawrence Commission of the United States and had as chairman Hon. Herbert Hoover. The Canadian committee was termed as the National Advisory Committee and had as its chairman the then Minister

of Railways and Canals, Hon. George F. Graham.

The report of the Joint Board of Engineers was issued in July 1927. This report in its essence substantiated the conclusions of the International Joint Waterways Commission's report. Its recommendations were, however, more elaborate and at the same time more definite. As I have mentioned above, the joint Board of Engineers dealt with the project from its engineering feasibility. It conducted its surveys most efficiently; it took great pains and care to see that nothing was neglected. In fine, it studied its work most exhaustively and in about three years time presented a report that was complete in all essentials from an engineering view, but one: the two sections of the board disagree as to the best scheme of developing power in the international section. I shall deal with the findings of these boards in subsequent pages. At the present time, I might mention that discussions on the St. Lawrence waterway project are rife, at the Federal, provincial and state parliaments in both Canada and the United States.

CHAPTER 4.

CLAIMS OF PROPONENTS OF THE ST. LAWRENCE WATERWAY PROJECT

In the preceding three chapters a brief historical account has been given of the navigation improvements, power plants and international treaties and agreements existing on the St. Lawrence waterway. This has been done, for the purpose of better acquainting ourselves with the object at hand. It is very essential that we should have a definite understanding of what this waterway really is. It is not merely an inland sea like the Mediterranean but a series of fresh water seas at different levels, that are linked together by another series of connecting rivers whose turbulent waters and tumultuous cataracts render navigation through natural channels impossible.

The subject with which we are directly concerned is a study of the economic possibilities of this series of inland seas, as they affect Canada and the United States. We have ~~x~~ observed how in the past both countries have recognized the economic value of the waterway as a transportation medium and have consequently built canals and dredged connecting channels from the head of the lakes down to the ocean to take care of the traffic requirements of the times and of the near future. In addition, public and private bodies have

discovered the vast power resources latent in the numerous rapids and have accordingly utilized some of this latent energy by developing it at Sault Ste. Marie, Niagara Falls and the St. Lawrence river proper in its upper reaches, to say nothing of the power developed illegally at Chicarro. We have noticed how both Canada and the United States, recognizing that this waterway had great potential international complications had formed international treaties and agreements in order to alleviate any future difficulties that may arise, and in order to prevent the dire consequences that such complications may bring forth. As a result of these treaties both Canada and the States have a definite status with regard to the St. Lawrence waterway. They both have privileges and duties definitely outlined in the treaties. Any difficulties that have arisen, concerned interpretations of clauses in particular treaties. Some are still unsettled but they are not serious enough to break the goodwill that exists between the two most modern nations.

Ever since the commencement of the twentieth century there has been more or less active agitation, particularly from the American West for a deep waterway from the head of the lakes down to the Atlantic ocean through the St. Lawrence river. This agitation has become exceedingly influential and active since 1918 until at the present time, February 1929, it is receiving the widest attention. Originally the pro-

ponents of this scheme demanded a through waterway, with a 25-foot depth to permit a 7,000 - 8,000 tons ocean boat to ascend the river up to the head of the lakes. The present ~~x~~ view states that this scheme which is called the St. Lawrence Waterway project, is designed to link up the oceans of the world with the Great Lakes of the North American continent by means of a continuous ship channel, at least 27 feet deep, which would permit ocean freighters to steam inland 2000 miles from the sea and return to foreign lands laden with the products of this continent. The necessary depth of water would be obtained in the upper reaches of the St. Lawrence river, where the chief obstacle to the movement of large steamers is to be found, by daming the river and flooding out rapids that now hinder navigation. The backing up of the ~~x~~ stream would permit the harnessing of its tremendous water energy and the development of 5,000,000 horsepower of electricity, 3,000,000 of which are entirely within Canada and 2,000,000 in the international section of the river.

It is admitted that the power aspect of the project, though important, is of a local character. It will benefit ~~x~~ directly only those districts within a radius of 300 miles. That means an area embracing the most prominent industrial communities of the Dominion representing one-tenth of the provinces of Ontario and Quebec. The United States would not ~~x~~ benefit to the same extent as Canada by the power development,

for it is entitled to half interest on the power generated in the international section. The rest is all Canadian.

The above assertions are merely superficial statements by the proponents of this scheme. It is essential if we are to understand their attitude to discuss the advantages attributed to the deeper St. Lawrence waterway by its advocates on the one side and the criticisms of the project on the other.

The benefits of the proposed St. Lawrence waterway are divided in two sections. Firstly we shall deal with the advantages that will accrue to the United States: Secondly, with those that will accrue to Canada.

United States' benefits - The benefits that will accrue to the American people are subdivided into (a) those due to the navigation improvements and (b) those due to the regeneration of power. These are further subdivided into theoretical, potential and immediate benefits. Let us deal with the benefits due to navigation.

It is evident that the entire United States is now expected to benefit directly from this project. The states to benefit from this improvement are those tributary to the Great Lakes and St. Lawrence waterway. Some of the states in the interior of the continent may be said to be marginal states; states which may be said to be tributary to this route when transportation rates via this waterway are cheaper than any other, at any given time. There may come a time when rates due to competition may be lowered on other competitive

routes and the traffic would then flow by the cheapest route.

There are certain states, however, which may reasonably be expected to always seek this route if a deeper waterway were provided with efficient transportation facilities. These are sixteen in number and are united in the movement for a deep waterway connecting the Great Lakes with the ocean. These states produce about 75% of the wheat, 65% of the corn, 100% of the flax, 85% of the iron, 39% of the copper, 74% of the zinc and 46% of the lead of the entire American republic.

The limits of these sixteen states are approximately fixed by the relative costs of transportation by all available routes. This area will differ for overseas commerce as compared with purely domestic trade. [In case of commerce going abroad, the use of the ocean carrier is of most importance and the sooner the traffic could be placed upon that carrier the better. This prevents storage charges which are a death blow to trade. This becomes more emphatic when one considers the excessive terminal charges at New York, coupled with the inefficient state of the American railroads. We can claim then that the present railroad facilities of the United States are at a disadvantage with a deep water route to the ocean for foreign trade. In cases where no transfer is necessary it is evident that the waterway provides distinct economic advantages.]

The distance by the all water route from the Great Lakes to Liverpool is a little less than the rail and ocean route

from these same ports to Liverpool. One third of the distance by the latter route is by rail. To take the most extreme port the distance from Duluth to Liverpool by the all water route is 4,546 miles. By the water and rail route it is 1341 miles by rail and 3578 miles by water from New York. From the ✓ important American lake ports the distance to Liverpool is at least 400 miles shorter with the exception of Chicago which makes little difference. In addition to this, these ports save a railway haulage ranging from 442 miles in the case of Buffalo to 1391 miles in the case of Duluth. Thus this shorter route will afford economies in transportation from these ports it cannot be denied.

Lake Erie ports are practically upon an equal footing with Atlantic ports so far as distance is concerned. With the opening of deep water navigation on the St. Lawrence, the haul from these ports across the country to Atlantic ports would be an unjustifiable expense. The slow and inefficient barge canal is still worse. Traffic from these ports would therefore seek the waterway. But traffic that ✓ requires quick and steady transport service such as that offered by the ocean liners may still be expected to neglect the extra expenditure for the sake of stable transport service and quick dispatch. In speaking, therefore, of freight, we shall refer to traffic that now seeks the tramp service, not the expensive and regular liner service.

Knowing the above advantages of the lake ports when

provided with a deeper waterway, the next consideration is to discover how far inland areas would seek these ports in preference to Atlantic ports. We have said above that on the basis of distance and irrespective of the cheaper transportation which vessels are known to afford as compared with railways, all ports located on the Great Lakes should find it more profitable to utilize the proposed waterway. When we consider the lower costs which are inherent in water transportation as compared with railways, the advantages of this route will be found to extend to practically all destinations to which it affords direct access. These advantages, if we add that of avoiding congestion at and around the Atlantic ports, the benefits of the waterway are manifest. But traffic originating in and around these ports would not be sufficient justification for the execution of so gigantic a project. We must know also to what extent inland areas, whether industrial, mining or agricultural, would seek this route in preference to any other.

The distance factor is here again used to bring out the advantage. From Pittsburg, Tenn., to Liverpool via the three shortest Atlantic routes, the distance varies from 4,022 to 4241 miles; of these distances the rail varies from 444 to 334 miles. Via the Lake Erie ports of Cleveland, Ashtabula and Erie the distance varies from 3870 to 3787, of which the rail distance varies from 147 to 124 miles. From Pittsburg

and its immediate district there is not only a saving in the total distance via the Lake Erie ports, but also the saving in rail haulage which is about two-thirds less than the Atlantic ports route. The entire Pittsburg manufacturing and industrial area would on this basis alone prefer the new route. ✓

From Cincinnati to Liverpool via the best or nearest Atlantic ports, the distances vary from 4500 to 4335 miles. Other total distances the rail haul varies from 757 to 593 miles. By way of the Erie ports of Cleveland and Toledo the total distance is 3198 and 4023 miles respectively. Of this ✓ distance the rail haul is 263 and 211 miles respectively. ✓ Here too, distance favours the lake ports. The same or similar facts are discovered when we consider the Louisville Kentucky to Liverpool route. ✓

These figures and examples are given to show the decided advantage in favour of the lake route. To be accurate, we might mention that the water route via the Atlantic route is in many of the above cases shorter by from 100 to 300 miles. But this is of no or at most of least consideration over such long distances. The primary factor that these illustrations are intended to show is the saving in railway haulage, that is secured by the new route. In many cases it is so great as to offset the water distance advantage possessed by the Atlantic ports. *

Continuing, let us take the Nashville, Tennessee to Liverpool traffic. The distance

via New York	is rail	998	water	3578	total	4576 miles
" Philadelphia	"	907	"	3743	"	4650 "
" Baltimore	"	810	"	3907	"	4717 "
" Norfolk	"	801	"	3768	"	4569 "
" Charleston, S.C.	"	598	"	4078	"	4674 "
" Savannah	"	583	"	4161	"	4744 "
" Mobile	"	485	"	5233	"	5718 "
" New Orleans	"	626	"	5312	"	5938 "
" Cleveland	"	563	"	3735	"	4298 "
" Chicago	"	444	"	4453	"	4897 "

These figures according to Mr. McElvie in his book on "Economic Aspects of the St. Lawrence Waterway" show that the shortest route from Nashville, Tenn., to Liverpool is by way of Cleveland and the shortest railway haul by way of Chicago. The water haul from Chicago to Liverpool is 859 miles less than from New Orleans and 1,043 miles less than from Galveston, while the waterhaul to Cleveland is 1577 miles less than from New Orleans and 1761 miles less than from Galveston. Nothing is said however of Savannah and Charleston, S.C., which as far as distance is concerned is just as advantageous as Cleveland both as to rail and water haul. He concludes that these important advantages indicate that the area tributary to the Great Lakes route will extend considerably more than half the distance between the lakes and the Gulf of Mexico, so far as traffic to Northern Europe is concerned.

Another advantage attributed to the Great Lakes route, is that since perishable commodities, such as meats, grains and others are subject to deterioration in warm climates, this route would be particularly desirable.

For these reasons, therefore, it is claimed, the tributary territory would include all of Missouri, of Kansas, Colorado, Iowa and all states to the North. Traffic originating directly on the Mississippi river below St. Louis would be tributary to New Orleans, but all above would be tributary both to New Orleans and Chicago.

On account of the long water haul from the Pacific Coast to Liverpool, it is obvious that the western limit of this area extends beyond the point of equal rail distance between lake and Pacific ports.

Considering the distance from Denver to Liverpool, via San Francisco, and the Panama canal, the distances are as follows:

	Rail	1,376	water	9024	total	10,400	miles
via Los Angeles	"	1,417	"	8601	"	10,018	"
" Galveston	"	1,123	"	5496	"	6,619	"
" Chicago	"	1,018	"	4453	"	5,471	"
" Cleveland	"	1,375	"	3735	"	5,114	"

Here then it is expected that traffic will seek two routes, the Great Lakes and by way of Galveston. Further west we cannot go for although the saving in water distance

by way of the Great Lakes is about 4,000 miles, yet the rail haulage increases to such a point as to favour the Pacific coast. How far this tributary area will extend therefore will depend on the railway rates. For this reason and because competition between the different routes will always exist, it is impossible to set any definite limit to the tributary area.

It must always be kept in mind therefore that since ~~X~~ the comparative cost of rail and ocean transportation varies within rather wide limits, from time to time, the margin of this tributary area will be as often shifting. For this reason an estimate of this area on the basis of distance is believed to be of more permanent applicability than an estimate based on rates since rates are so frequently changed.

Mr. McElwee makes similar distance comparisons with the Mediterranean trade and finds that the advantages of the lake ports still hold but that the tributary area would be further limited.

It is a fact that railway rates are more stable than ocean rates which are changed according to the demand for vessels. No reliance can therefore be placed upon the maintenance of a given rate by a vessel. For purposes of comparison, therefore, the expense of the ocean haul may properly be assumed on the basis of the cost of operating a vessel of suitable type and capacity over the particular route under consideration.

In general terms it may be said that the cost of operating a given vessel over one route as compared with another is proportional to the time required for the two journeys although some variation in cost due to insurance, port charges, etc., may be involved, as well as the rate of speed.

The passage of vessels through the restricted channels of the waterway affects the cost to the extent that it increases the time of transit. But this increase in cost would not be much. There would be in addition, the extra insurance. Even here, however, a definite cost cannot be given. Total extra cost can only be estimated. Proponents of the scheme claim that the total extra cost of navigating the Great Lakes to Duluth would be one quarter greater than the New York Liverpool route. But all this is offset by the cost of transfers and incidental expenses at New York and other Atlantic ports. They maintain that the promptness with which shipments can be dispatched will be a controlling factor upon the routing of traffic from competitive territory. This efficiency the ports of the Great Lakes will possess to the alleviation of over crowded Atlantic ports which lack these facilities.

Shipping companies charge practically the same rates for freight from Liverpool to Boston, Philadelphia, Baltimore and Norfolk, as to New York, though Baltimore is 535 miles further, and the distances of the other ports vary

greatly. Now we know that Baltimore is 172 miles farther from Liverpool than Cleveland which is at the end of Lake Erie. This difference would more than offset the time lost in restricted channels below Lake Erie. Might we not suppose on prima facie evidence that the vessels will make the same rates to Lake Erie ports as to North Atlantic ports.

The flaw in this argument is that tramps do not as a rule go to New York but prefer the other ports: that no sensible person expects liner service to be inaugurated between great lakes' ports and Europe after the deepening of the profit. That the equality of rates referred to can mean nothing else but liner rates: that these will not affect the Great Lakes and finally: that the rates to be considered are tramp rates which are essentially competitive rates and therefore cannot be predetermined.

But as a rough approximation excluding New York and Boston which are liner ports primarily we may say, that tramps do charge rates to these different ports that are almost equal.

Again it is said that vessels from N. Europe charge a rate $15\frac{1}{3}$ greater than the North Atlantic rate to New Orleans, though the distance is 1800 miles greater. It would be reasonable to expect the same rates to Duluth and Chicago which are approximately 1000 miles nearer and would therefore more than offset the slight physical disadvantages of the lake route. The time actually required for the trip,

not counting time in port, would be several days shorter than from the Gulf ports and the cost proportionally less.

To ocean rates one must add the expense of the rail haul from points in the interior to ocean ports. By the water route this extra expense would be minimized, though there would still be points that would be indifferent to the various routes.

Assuming, therefore, that there is a large hinterland around the Great Lakes whose railway distance to these is less than to Atlantic ports, can we therefore say that the rates are going to be proportionately less? If so, then a great deal of traffic would be diverted to this route rather than the Atlantic one. There would be an increase in the former and a diminution in the latter route. But then what is to stop the railways from raising their rates to lake ports and lowering them to Atlantic ports. The policy of railways in the past has been to provide traffic over their whole lines. They will not be content to have all traffic going via lake ports and little or none via Atlantic ports. If there is any advantage to be gained by way of the new route might we not suppose that a great deal of it will be absorbed by the railways, who, seeing that they can increase their rates without diminishing the volume of traffic, will do so. As it is now, the railways charge export traffic what it can bear, they carry it all to the

Atlantic ports. As soon as the new route is completed, we'll assume that a great deal of this traffic will be diverted to the new route. Are we also to assume that the railways will be idle and permit a traffic which formerly paid them a certain rate to now pay them so much less. It is maintained that the water distances from the Great Lakes ports to Europe are approximately the same as the Atlantic ports; that the benefit will be mainly from the shorter railway haul to the ports. That means that whereas formerly the railway carried a great deal of the traffic over relatively longer distances that now because the distance will be materially less, they should be content with a smaller rate. But one of the greatest principles in the making of railway rates is that distance is a relatively unimportant element in the determination of rates. What primarily determines railway rates is the cost of service in so far as that can be determined and what the traffic can bear. If the railways see that traffic that formerly travelled one way is now diverted to another, they are not going to lower their rates because this route happened to be shorter; if they comply with such an unreasonable request they would be losing so much revenue that they formerly obtained. What they will likely do is to still charge the same rates over the shorter route as over the longer Atlantic route. In this way they will be avoiding discriminating against the Atlantic ports; and

at the same time be none the worse off as to revenue. What the railways seek to accomplish is to have traffic travelling both ways. They want all their available cars used all the time and in all directions. If this waterway is going to mean that little traffic will travel to and from the Atlantic ports then the cost of operating the lines must be made up from traffic that can pay on the former route. Where is then the real advantage of this waterway? It has been said that commodities that are not particular about fast and regular service will seek this route: but will they not equally well seek the Atlantic route, a highway to which they are already accustomed; if rates on land are going to be the same either way despite the difference in distance, ought we not to conclude that traffic will follow the already established channels. The whole problem, therefore, rests with the railways. As to traffic originating at or near the lake ports, we may grant that they'll prefer the new route; but when we consider hinterland traffic the whole situation becomes an enigma.

Similar examples are given to show the advantages this waterway would have over established routes, in the South American trade. It is shown that the distance from points on the east coast of South America to Lake Erie ports and others by way of the St. Lawrence is less than via the Gulf ports. The distance from similar points to New York

is less than to lake ports but the difference is by no means sufficient to overcome the cost of transfer at New York and the cost of the rail haul. For example, there is no doubt that raw sugar can be shipped from Havana to Duluth direct by water at less cost than it can be shipped via the Atlantic or Gulf ports. The same may be said about bananas, binlap, sisol, coffee, rubber and other south american products. Though the water distances may be shorter, yet the heavy transfer and warehousing charges offset this disadvantage.

The above claim again is only true in so far as the lake ports and their immediate vicinities are concerned. As to the inland cities and districts, we cannot substantiate such assertions for we do not know what the railways propose to do. Again, the degree of this advantage will again depend on water rates and to the extent that middlemen organizations will absorb any benefits that this waterway offers.

In their zeal to expound the advantages of their project, advocates of the St. Lawrence deep waterway have either neglected or forgotten to consider the prominence of distance, in other words, time and speed in water transportation and the relative unimportance of distance as a factor in railway rates.

They offer similar advantages to the coastwise traffic that is to be developed between the lake and Atlantic ports.

This involves the substitution for the existing railway haul of water, haul of greater length than the former. The problem here is one of comparative costs of the two methods. In the case of points not directly reached by the water carrier, the cost of transfer and land haul must be added. But that there is a substantial amount of direct traffic between the ports cannot be doubted. The traffic, therefore, that will use this route will comprise of bulky commodities that cannot afford to go by rail and slow package freight. For example, wool, hides, salt, copper, iron, steel, grain and other agricultural products will play an important part in this coastwise trade.

It is maintained that since the opening of the Panama canal, the Pacific coast received competitive railway rates to the detriment of the trans-Mississippi country: that the opening of this route will therefore put competitive railway rates into effect to the benefit of this district. The same advocates here seem to forget that localities not situated on or near the waterway will not benefit by these lowered rates. The railways may at their liking put in a competitive rate from the Atlantic to the lake ports direct, but it is a known fact from past experience and as the Mississippi example well demonstrates, that intermediate points that cannot take advantage directly of the waterway will not get them.

Proponents of this scheme believe that as a result of

the cheaper transportation rates, and direct water communication from overseas ports to lake ports, commerce shall so greatly increase that in addition to most of the existing ports becoming veritably renowned ocean ports, new ones of great prominence shall arise. The future of the United States which according to them seems to be centred around the Great Lakes, will be determined by the efforts made to extend their commercial relations with other countries. Economical transportation between areas of production and foreign markets is one of the requisites of successful foreign trade. Competition in world trade is very keen both in raw and manufactured materials. To overcome such competition, superior quality of goods, improved machinery, quantity production, all of which require cheap electrical power and economic transportation are the prime essentials. Of all these, the last will be greatly advanced by the opening of the Great Lakes to ocean vessels. Thus this route will provide transportation facilities for the economical shipment of raw materials and manufactured products of a tributary area whose extent cannot be determined because of the uncertainty of future railway policy. It is a tributary area whose extent is considerably diminished, if we gauge it by present railway policy and which becomes indefinite if we admit that we do not know how the railways will react when the waterway becomes a reality.

American advocates maintain that this area has a population of over 40,000,000 people. They include as the limits of this territory, parts of the States of Idaho, Utah, Colorado, Kansas, Missouri, Kentucky, West Virginia, half of Pennsylvania and New York.

To my mind, the extent to which this territory may utilize the proposed waterway no one can portend with any degree of accuracy. About the only certain element in the above estimates is that the immediate territory around the Great Lakes will find it advantageous to utilize it. These will use it because it will avoid transfer charges. But inland points will probably utilize the waterway in foreign and domestic trade, not because in the former case they will avoid transfers which cannot be avoided by either this or Atlantic route but because of the superior service that the new terminals and ports on the great lakes provide over the old Atlantic ports; indeed in the latter case, these inland districts will find it to their benefit to ship by rail and avoid the transfer charges which shipping by rail and water would involve them in.

It is truly said, however, that there is congestion at the existing American gateways and terminals during peak periods. This trouble would be alleviated and perhaps totally eradicated by the opening of this new route. Railways cannot afford to provide the excess equipment and the excess

facilities at terminals to meet the heavy traffic burdens during crop moving periods. The overhead charges on this excess equipment will not justify its purchase solely to meet the requirements of periods of heavy traffic and yet it is at such time that the interest of the United States in adequate transportation is the greatest. The products of the country must be gotten to the world and domestic markets at the period of greatest demand. Inability to provide such service creates vast losses to the American people. The waterway can provide this service because there is a flexibility of operation in water transportation that is not shared by the railroads. Vessels can be allocated to ports and routes to meet the exigencies of trade conditions.

For all the export traffic from the immediate lake states and much of the domestic traffic destined for the eastern seaboard, the St. Lawrence river will furnish a direct route with an average saving of 800 to 1500 miles of rail haul and the elimination of the cost of transfers in the foreign trade case, involved at Atlantic ports. Irrespective of the actual saving in cost to the shipper, which will be substantial, the substitution of short rail hauls to the Great Lakes, which will undoubtedly take place if nearby inland districts take advantage of the waterway, in place of long rail hauls to the Atlantic will result in vast improvement in general transportation conditions of the country.

The main expense in long hauls is the terminal. These terminals have been so awkwardly constructed that great delays are suffered. These mistakes can be avoided by building better and cheaper terminal facilities at various lake ports when these become open to ocean traffic. Terminals at the Atlantic ports cannot be profitably enlarged for the point of diminishing return with an increase in their present sizes is soon reached. The problem as it exists at the ocean ports is that before a commodity is finally settled in a ship's hold it is handled several times, not only increasing expense but actually ruining fragile commodities such as glass. By the building of modern terminals, these commodities can with a single transfer be placed upon the ship.

The knowledge gained in recent years in reference to port facilities and efficiency is such as to make it possible now to so plan the development of lake ports as to insure the utmost economy in the transfer of freight from rail carriers to the vessel and to permit indefinite expansion without undue congestion.

We may conclude then by saying that whereas the advantages to be secured by immediate great lake districts are manifest, those that will accrue to inland districts will depend upon the facilities and efficiency of the lake ports as compared to the Atlantic ports. The St. Lawrence water-

way will again be of real service to the railways by relieving them of heavy bulky freight and of the longer hauls were practicable. The railways by confining themselves to relatively shorter hauls could be able to provide better service. With the increase of the country's commerce as compared with the railroad facilities available, this plan would increase rather than diminish the earning capacity of the railroads by enabling them to carry a much greater volume of better paying freight.

In considering the adaptability of the waterway for the transportation of the commerce of the Great Lakes region, it must be understood that this trade consists in large part of high class manufactured articles which are now shipped by rail across the country to Atlantic ports. This traffic enters largely in American foreign trade and is of the class on which transfer charges are the heaviest.

Large saving in the transportation of American wheat are anticipated. Whether the wheat is used for domestic purposes or goes abroad a substantial quantity it is expected will move by this route.

Vast quantities of coffee from South America consumed by these tributary states that is now being distributed by rail from New York and New Orleans to the extent of about 180,000 tons, will seek the cheaper St. Lawrence route. Similarly, cocoa, to the extent of 155,000 tons, sugar

877,000 tons, bananas and other tropical fruit and nuts to the extent of 500,000 tons are expected to prefer the cheaper and better accomodating lake route. About fifty per cent of the rubber imports of the United States are destined for the lake regions. It is only reasonable to expect this to follow the course of the rest. Fertilizer, a commodity greatly needed in the West, would be greatly cheapened by coming direct to the lake ports of the west by water.

The outbound traffic provided by the American tributary states is certainly of a variant nature. Steel industries along the New England coast could have their raw material brought to them direct by the cheaper all water lake route. This convenience it is expected will develop both the domestic and export trade of steel and iron products.

The freighters leaving their South American products at the lake ports can take coal as a return cargo.

The salt industries of Michigan will prosper because salt that is now brought to New England fishing industries from England, Spain and the West Indies could come from Michigan, the largest salt producing state in the Union.

Copper, it is claimed, would become one of the important commodities in the coastwise trade between the Great Lakes and New England ports. The State of Michigan produces 56.5 of this commodity and could use this route advantageously.

Most of the meat and dairy products originate in the tributary states and in order to enable American exports to compete more effectively with Argentina and Australis, the St. Lawrence waterway, which will provide cheaper transportation, is imperatively needed.

The American ship-building industry will receive a great impetus when the St. Lawrence project is completed.

It is realized that the United States is a vast country holding within its borders and producing practically every conceivable human want and luxury. It has a tropical and temperate climate. Its agricultural products are therefore varied as in no other country. The foreign trade that satisfies the wants of countries more restricted is not an essential to the American republic. Yet there are certain commodities that are essential to its industries and which it cannot obtain unless at great cost within its borders. The commodities that have been enumerated above are cases in point. They are of vast enough importance coupled with the exports of the United States to be given as arguments in favour of a deeper water route.

Of the total freight carried through the Sault Ste. Marie canals, \$125,000,000 was for general merchandise in 1920, while in 1887 it was merely \$25,000,000. The traffic through the Soo in the order of its commercial importance in 1920 was iron ore, wheat, general merchandise, coal, flour,

other grains, copper, lumber and other bulky and of little value commodities.]

Of course, if ocean vessels did not find it profitable to enter these lakes then the arguments of these advocates would be meaningless. So they propose to show how ocean vessels will find it to their advantage to engage in trans lake ocean trade. It is understood by all that ships constructed solely for service on the lakes are not suitable for ocean navigation, at least not without strengthening and other expensive alterations. This, however, is considered unimportant by them. The vessels that will carry the commerce of the Great Lakes to foreign markets are the ships of average size now engaged in ocean service. With a depth of 25 feet or more through the St. Lawrence River, the standard steel vessels of 8000 tons and under could operate successfully on this route, taking on grain and other heavy cargo at upper lake ports and completing the load with manufactured articles at Lake Erie ports.

Mr. McElwee gives us a definite example. According to the American Shipping board the distance from Duluth to Liverpool is 3936 nautical miles as compared with 3050 to 3105 from New York to Liverpool. The fact that tramps mostly go to other Atlantic ports still farther away substantiates this argument further. Thus there is a difference of 886 or 1772 miles per round trip. If Baltimore be taken as

the starting point then this difference becomes considerably less since that city is 500 miles further than New York. The same board has estimated that an 8,800 ton steamer has a designed speed of $10\frac{1}{2}$ knots and her cruising speed has been assumed as about $9\frac{1}{2}$ knots. Her total time per round trip between New York and Liverpool is 47 days of which 21 days are spent in port and 26 days on the sea. It is significant to notice the time wasted at port which can be considerably diminished if better terminal facilities are available. This additional 1772 miles on the Great Lakes would require $7\frac{1}{2}$ days if the navigation were all in open waters. The improved route, however, from Montreal to Lake Superior would involve a maximum of 100 statute miles of improved river channel and 50 miles of canal navigation. The former will require ten hours and the latter sixteen hours at the most to navigate including delays incident to lockage. In open water this 150 miles could be covered in 13.4 hours. Thus there is a delay of 11.6 hours each way due to restricted channel or one day per round trip making a total of $8\frac{1}{2}$ days extra for the lake trip, or 56 days at most per round trip to Liverpool, with time in port similar to Atlantic route. A great deal of this travel can be eliminated with better terminal facilities. In the above calculation, four round trips would require 224 days. The average length of the navigation season at St. Mary's Falls canal and the

St. Lawrence canals is 220 days. But if no time in port is considered on the initial voyage of the season as the ship would be practically loaded and ready to sail upon the opening of navigation, four round trips per season are easily possible even with the excessive time in port as on the Atlantic route. But we must not forget that these lake ports will provide terminal facilities of the most modern type, eliminating a great deal of this wasted time at port.

If the initial trip be made from Liverpool or some other winter route, the vessel will be able to make the four trips to lake ports and be out of the St. Lawrence before the close of the navigation season. This arrangement would have the advantage of completing the season's work with the vessel in open waters where she could be placed on other routes during the winter. The total time required with Liverpool as the terminus would leave 106 days surplus which would be more than sufficient for two round trips from Liverpool to an Atlantic port. Thus in 330 days the vessel would make six round trips as compared with seven on the Atlantic route.

The benefits enumerated above were given as an example to show the standing taken by the advocates of this project. I have dealt with advantages that may be more appropriately termed as theoretical benefits. There are still others to be considered namely practical potential advantages. Benefits

that one who has studied the subject may reasonably expect to accrue to the United States. But even these are based on estimates and as such deserve to be either discounted or increased depending on ones personal view. But as the authorities from which they are taken are trustworthy, that is authentic in so far as persons specializing in a particular work can make them, we may perhaps accept them with reservation, by upholding the principle that even the best of err making estimates.

This estimate is based upon the tributary area that I have described above. About one-third of the total population of the United States is segregated in this territory. The productive resources of this area are the largest in the American republic and have been enumerated briefly above. The Department of Commerce of the United States of America have issued a pamphlet in 1927 called Great Lakes to Ocean Waterways. In this document they have estimated that the potential tonnage available for the waterway would be about 3,000,000 tons of import traffic, 6,400,000 tons of export traffic and about 7,000,000 tons of intercoastal and coast-wise, giving a grand total of 16,400,000 tons. This figure is regarded as conservative because it does not account for increased transportation requirements by the time the proposed route is established.

The predominating movement of the export of grain trade

of the United States, at the present time, includes an all rail haul to seaboard ports and thence abroad by liner or tramp steamer. According to 1924 grain rates from Chicago to Liverpool, the new St. Lawrence route would save the American grain shipper about 6.5 cents per bushel over the lowest existing combination rates.

The furniture industry of the United States is largely centred in the State of Michigan and several bordering states. These states were famed for their hardwood. These supplies have become depleted and these states depend upon the Pacific and south coast regions for about 77 per cent of their lumber needs. About 25 per cent of this necessary supply is obtained from the Pacific coast and moves to the Great Lakes region by two routes, namely, the all rail direct route, and all water via Panama canal to the Atlantic coast plus the rail haul to this region. The statistics department of Agriculture of the United States shows that in 1922 Michigan and Illinois consumed 1,700,000 tons of imported lumber. Approximately 400,000 tons was supplied by the Pacific coast regions. Savings in transportation by various indicated routes have been figured on the basis of out-of-product costs. These show that the saving to be effected by an all-water haul from the Pacific coast via Panama canal and the proposed waterway to Chicago over the all-rail movement, direct, would amount to approximately nine dollars per thousand board feet,

while the saving to be made by the former over a movement to New York by water transfer at New York and rail haul to Chicago is somewhat less, or about eight dollars per thousand.

It is an acknowledged fact that the Lake Superior region produces 85% of the total production of iron ore in the United States. This ore is moved by lake freighters to ports on Lakes Erie and Michigan for distribution to smelting centres. Only a small proportion of this ore reaches the Atlantic ports and region due to the very high cost of an all-rail haul from Lake Erie ports. Instead, a great deal of the ore consumed by the Atlantic sea board comes from across the Atlantic. The importation of the foreign ore is not due to scarcity of the product in the United States but to the fact that it can be delivered cheaper than the Lake Superior ore. The deeper waterway along the St. Lawrence should therefore remedy this anomaly.

With the St. Lawrence waterway completed a part of the package freight from the Great Lakes region which now is largely handled through New York may reasonably be expected to seek this route. At the same time the United States railroads which are now taxed to capacity will not be injured but on the contrary aided by having traffic, that can go by either route, move by the waterway. Investigations by the afore mentioned department showed that the cost of rail haul on package freight to be about \$5.70 per ton; while the

cost by a tramp steamer is about \$2.70 per ton. This would indicate a possible saving of about \$3 per ton.

Based on 16,400,000 tons of traffic therefore as estimated by the U. S. Department of Commerce Report, the annual saving in transportation costs will amount to about \$22,200,000 per annum.

Along with the above alleged advantages as a result of the improvement of navigation, are the benefits to be derived from the power that is to be generated on this waterway. The electrical power to which the Americans are entitled is that developed at the international section of the waterway. As I have described in preceding chapters, this section is between Lake Ontario and the town of Cornwall. The available power at this section is slightly over 2,000,000 h.p., half of which belongs to the United States. The power developed can be profitably disposed of, to an area within a circle of 300 mile radius. Judging from the demands that American industry has made upon electricity within the past few years and is continuing to make, there appears to be no doubt whatever in the minds of men who have made a special study of the situation that all the power that can be developed in this section and offered to the American public will be famishly consumed by their industries.

That the Americans are looking for cheap power to further develop their industries there is no doubt. American capital is always strongly behind any gigantic power enterprise.

Not only have they a ready market for their own power but are gladly willing to have us send some of ours to them. The possibilities that the power development in the international section has for American industry are disputed by none. They may differ as to plans for its developments, but that it is needed immediately none will deny.

Speaking in monetary terms this power can be sold at \$15 h.p. That means \$15,000,000 annually. The cost of construction of power development in the international section is estimated at less than \$300,000,000. The interest charges and maintenance charges are estimated at \$17,500,000 per annum. Let us say \$18,000,000. But half of this cost is to be borne by Canada whether the undertaking be private or public. The total charges therefore for the development of the one million horsepower is \$9,000,000 per annum, leaving a clear profit of \$6,000,000.

But there are other theoretical advantages to be derived from power. The American consumes annually large quantities of coal. As time passes the price of coal rises, because of the increasing difficulty of mining it. Americans are everywhere talking of the conservation of their coal supplies. Again the fact that electricity is more convenient, cleaner and more efficient to the industrialist makes itself the industrialists' motive power therefore, will be developed on the American territory adjacent to the international section.

The fact that industries here will prefer the cheaper electrical power to coal means that other industries that must still depend on coal will be able to get it cheaper and so many marginal industries will be helped.

To the United States the development of power here means the conservation of coal and therefore cheaper coal supplies and cheaper power in that particular area. It means the establishment of new industries in a section not so favourably situated with regard to cheap power without this development.

I do not wish to leave the impression that no water power is being developed within this 300-mile area for there is but it is relatively insignificant to the power proposed. There is at present the plant of the American Aluminum company at Massena which develops considerable power by a diversion of the St. Lawrence waters. Such a step would at the present time be illegal without permission from International Joint Commission. These people however, got their authority from the American government in 1896 before the creation of the above committee. The diversion, therefore, is not looked upon like the Chicago one, as a breach of treaty rights.

Canadian Benefits - The benefits that will accrue to Canada may be classed also as theoretical and potential. Here, the advocates of the scheme cannot peruse in eloquence as was the case with the United States. The tributary area on the south side of the lakes claimed 40,000,000 people. The Canadian side claims but 4,000,000. What a contrast! Our country, tributary to the lakes, is like an hour glass, a productive agricultural section in the west consisting of Manitoba, Saskatchewan and Alberta, a relatively non-productive middle section, Northern Ontario and a productive manufacturing eastern section, Southern Ontario and Quebec. But here again the most progressive and productive areas of Canada are tributary to this route. It is maintained that what has been said about American advantages regarding distance applies with greater force in Canada. True, the population of Canada is only one-tenth that of the United States tributary to this route. But we cannot deduce from that that our country shall therefore benefit proportionately less. On the contrary we will benefit to a relatively greater extent than our cousins to the South. We are a new country; we are developing slowly but surely. Our centres of population are concentrated in the middle east and middle west. Between the two areas there is a long stretch of at present unproductive land. True it has great power and mineral resources some of the latter still

undiscovered. But these must lie downward until some energetic individual makes them available for man's use.

It is important to bear in mind the essential difference between the United States and Canadian tributary areas, particularly as to population and production. Canada, according to the International Joint Waterways Commission compares very favourably with the United States in territory and resources. That is to say, if the economically tributary areas on the American side were duplicated on the Canadian side of the boundary, the undeveloped natural resources of our side would compare not unfavourably with the undeveloped natural resources of the south side. But when these resources are considered in terms of trade and production, the situation is found to be radically different. In population, in transportation, in every branch of production in finance and in wealth, and in the actual volume of foreign trade, the disproportion between the two countries are so marked that they institute a serious factor in the problem. It is not to be inferred from this that we are an inferior nation; on the contrary on a per capita basis we excel the United States in foreign trade, waterpower development and in industry in general, though we are as yet primarily an agricultural country. As I shall explain later, the essential difference between the existing transportation situation in Canada and the United States is that in the

former railway facilities are in advance of its requirements while in the latter, so far as the tributary area is concerned, population and production have outstripped them. To meet this the railways must expend vast sums of money, so enormous that the railways are hopelessly caught.

Through this stretch of country penetrate the Canadian Pacific and Canadian National railroads. The former, a private, the latter a public transcontinental line. It is claimed that both of these railways are only getting a fraction of the traffic that they are capable of carrying. The answer to this riddle is easy to discover. Canada being a new country and anxious to develop as quickly as possible, has undertaken a railroad building program that has far exceeded her present demands. There is need, therefore, to utilize the railroads to their capacity through additional freight. What could better serve such need than the proposed waterway scheme? The Americans want the waterway as an additional transportation route, to alleviate the burden of their railways that are at present overtaxed to capacity. We want the waterway, not so much as an alternative route but as a feeder to our railways. Traffic shall come clear through to the twin ports of Port Arthur and Fort William. Here they shall discharge the products of Europe, South America and Eastern Canada in exchange for the products of the West.

Instead of the railways carrying traffic through north-

Ontario, through a non revenue producing area, between Eastern and Western Canada, the large efficient ocean and lake steamers coupled with efficient port facilities shall carry this trade. Only traffic that demands great speed will continue to move by rail. In this way that great expense that the railways suffer of traversing a long non-revenue producing area is eliminated. Instead of having to do so the railways will concentrate their efforts in the eastern and western Canada where traffic is more ample and better paying. The railways, as in the case of the States, will be operating on relatively shorter hauls, as for example from the West to lake ports and from inland points in the east to lake ports. The idea of the whole scheme is to have the railroads join the waterway penetrates, act as feeders to it and vice versa. In this way it is argued it will not be necessary to move many trains half empty one way and totally the other. The service across the undeveloped country will be provided but only to the class of goods that absolutely demand it. This will minimize the use of trains in that district.

It is maintained at the same time that during crop moving periods the existing railroad facilities find it hard to give efficient service. To meet this situation the railways are building additional cars. But that would be uncalled for with the deepened St. Lawrence Waterway;

for the railroads can concentrate their cars in the busy section of the country, by withdrawing them from the slack section and leaving the waterway to provide the service in competitive territory.

The cheaper rates that will be provided will enable new industries to be established at points where they can best secure external advantages. This coupled with cheap power means that the St. Lawrence section of Canada will benefit enormously by the establishment of new industries. Capital will flock in, and of course, population will follow.

The Maritime provinces and British Columbia would profit greatly from a deepened St. Lawrence, particularly the former. The seepage of population from which they are suffering would be checked and for the first time in decades grain could be carried to Halifax and St John at rates six cents per bushel lower than grain going by rail from Buffalo to New York. Flour mills would be established that would compete during the summer on even terms with mills located at inland points and that would be at a distinct advantage during the winter season when they could export flour direct from seaport. The mills would provide cheap mill feed, for lack of which the dairying, cattle and swine industries of the maritimes languish. The deep waterway would also enable Nova Scotian coal, which is now pre-

vented from going westward beyond Montreal, to reach the big X Ontario market.

When this wonder waterway is completed, the lumber and fish of British Columbia will be brought in larger quantities at greatly reduced rates through the Panama Canal and the St. Lawrence to the teeming population in the basin of the Great Lakes.

Preferring to remain silent about all these advantages, I will state however that contrary to the above belief, it is a known fact that fish require fast service, of the type that as regards fresh fish, only the railroads can provide efficiently. Concerning canned fish we may perhaps concur, remembering that such advantages are theoretical in essence.

Canada is seriously handicapped by the remoteness of her wheatfields from the sea coast. Every mile of expensive rail haul that our grain has to take reduces the return that the western farmer obtains for his labours, and places him at a disadvantage in the Liverpool market. Every mile that the grain has to travel in expensive little steamers from Lake Erie to Montreal, which carry one-sixth the cargo of the upper lake boats, increases the disadvantage. And every time that grain shipments have to break bulk cuts into the remuneration of our agriculturists.

The cost of moving a bushel of grain 1,000 miles, past experience has shown is 1.7 cents by an average sized ocean

steamer, 3 cents by large lake steamers and 13 cents by small steamers using the shallow St. Lawrence canals and 17.5 cents by rail. Each transshipment costs about 1.5 cents per bushel. The suffering of the Canadian farmer 2,000 miles inland is thus apparent, when one compares him with the Argentine who is seldom more than 150 miles from a seaport. It is stated that the Argentine pays 10 cents per bushel less in transportation expenses than the Canadian farmer. The American farmer is in a more precarious position.

Again, it is expected that Russia in the near future will be a great competitor in the world's wheat market. The proximity of her position to Liverpool will be a potent factor in her ability to undersell her competitors. If Canada is to meet this effective competition she must more than ever be able to cut down her transportation costs.

If the above statements were all as accurate as some suppose them, then the advantages of the route would certainly be gigantic and manifest. One wonders why then is the St. Lawrence project not undertaken at once? Evidently there are those who dispute these arguments or assumptions. Of these we shall speak later.

A strong contention in favour of the St. Lawrence waterway is the fact that Canadian government engineers have declared that the governing factor as regards the capacity of the present St. Lawrence canals is Lock No. 15 at Cornwall

which could handle without serious congestion between 8,500,000 and 9,000,000 tons in an eight month season. Advocates of the scheme claim that in the past Canada has recognized the importance of this waterway; that it is a natural highway and that it would cost less to transport on it, than on land. The sagacity of our statesmen in the past had provided a waterway that was excellent in meeting the requirements of their time and of the immediate future. Now, however, the capacity of these canals has been reached or at least nearly reached. In 1928 the traffic came close to the capacity of the waterway for it reached 8,411,542 tons, while in 1920 it was only 3,067,962 tons. If the rate of increase during the last eight years were to continue during the following eight years, which is the minimum time required to build the waterway, the capacity of our canals would be doubly taxed.

If this statement could be substantiated within the next two or three years, if within this period it can clearly be shown that the canals are taxed to capacity, and though traffic is continuing to come in strong, I think that we shall all agree that it is high time for improving the navigation facilities of the St. Lawrence. But at present, I do not think that though the contention is strong, it is powerful enough of itself to disclose the need for a deeper waterway.

Another contention is that our seasonal unemployment problem will be solved once and for all. As a result of cheaper transportation, as a result of the deeper waterway which will be open to vessels of all countries, new industries will be established to take advantage of the external economies that will be offered. One of these industries that shall experience a revival to an unprecedented extent is the ship building industry on the Great Lakes. This agency of itself would do more to solve unemployment than any other. Great Britain is a great ship building nation because of the fortunate geographical position she is in. Her coal and iron deposits are not far from the sea. Again, her maritime proximity enables her to utilize the much needed iron ores of Spain and other countries. Advantages similar to those enjoyed by England and even greater ones are portended for the Great Lakes region. With a deep waterway, cheap power and ample iron ore resources, all near at hand, the ship building industry will have an unlimited future.

Practically all the pulp wood of the American continent originates in Canada. There are vast quantities of it available in the Maritimes, Quebec and Newfoundland, which are not now available for consumption in the paper mills of the Great Lakes region because of the transportation costs. The improvement of the St. Lawrence it is said will establish

this industry finally in Canada, especially when the power resources adjoined to the region are considered.

All these advantages may be termed theoretical. Indeed, such advantages could be narrated, world without end, by the St. Lawrence advocates. In the above few extracts I have merely related a few of them in order to more definitely establish in our minds the real significance of so vast an undertaking.

We shall now turn to more specific advantages. Benefits that appear more realistic to the human mind, but which at best can only be termed as potential advantages. To estimate these benefits to Canada, it is essential that we determine the savings to be made in comparison with other routes, as well as estimate the volume of traffic offering. It is expected that before this project is commenced the New Welland Ship canal will be in operation and a transfer terminal will be erected at Prescott or for greater safety at Kingston. Estimates of savings must therefore be based on the use of the new terminal rather than those in use at Fort Colborne, Buffalo and Georgian Bay.

With the new Welland canal completed, the Great Lakes freighter will transport grain and other commodities from the head of the lakes to Prescott and Kingston, and there a transfer will be made to the existing 2,400 ton canal boats. These will carry the freight to Montreal along the

present 14-foot canals. At that city a transfer to the ocean ships will then be made. With the completion of the St. Lawrence project, it is expected that ocean boats will go straight up to the head of the lakes or else meet the large lake boats at Montreal and there transfer directly to each other. X

The saving to Canada according to the findings of the joint board of engineers and particularly of a member of it Mr. D. W. McLachlan, Canadian government engineer, are approximately \$15,000,000 per annum. The traffic that will develop through the proposed waterway will consist of bulk cargoes and package freight mainly. Canada's portion of the former will be mostly grain. It is worth while noting that grain exports via British Columbia ports have been increasing to such proportions that that province is now opposing the scheme fearing that with its completion she would lose some of her present hold on grain exports.

In appearing before the Senate last year, Mr. McLachlan has given comparative costs of transporting grain. He claims that cost of transporting grain from Edmonton to Liverpool via Vancouver and the Panama canal is \$11.39 per ton; via Fort William and existing canals \$12.55; via Fort William, assuming Welland Ship Canal built with a transfer at Prescott \$12.34; via Fort William assuming the St. Lawrence Waterway completed and ocean tramp service direct to

Liverpool \$10.63 per ton; while with a transfer at Montreal to ocean tramps \$11.27 per ton. These calculations reveal that at present there is a saving of \$1.16 per ton by the Pacific route over the cheapest existing route via the St. Lawrence. On the completion of the St. Lawrence project, however, this new route will effect a saving of \$0.76 per ton over the Pacific route. Thus the fears of British Columbia that some of the grain moving in that direction may be diverted, may be justified.

A fair estimate of the volume of Canadian grain that will be available for export via the St. Lawrence route is 4,000,000 tons per year, which is the amount now moving out via Montreal, Quebec and United States North Atlantic ports. The saving on this tonnage at \$1.50 per ton will be \$6,000,000.

There is a large movement of flour from the west via Lake to Port McMillan and rail from there to Montreal and the Atlantic seaboard for export. The average volume of this traffic for the last four years has been about 410,000 tons. Since this business goes by water part of the way, it is expected that this business would be available for the St. Lawrence Waterway. The growth of this traffic has been so steady in the past that basing the saving on 450,000 tons would not be amiss, which at a saving of \$3.60 per ton would lessen present transport charges on this freight

by \$1,600,000.

Lumber production in Ontario and Quebec is diminishing at the rate of over 50 million board feet per annum. Though the provinces will never be completely exhausted, yet their production will have to be materially curtailed. British Columbia is reported to possess three-fourths of the raw material available in Canada. One half of the timber sawn in Ontario is white pine which commands a high price in foreign markets. It is believed, therefore, that Ontario will prefer to purchase cheaper lumber from the west rather than use the white pine for most of its lumber needs. Rail shipments of lumber from the Pacific to Eastern Canada have been estimated to have increased from 150,000,000 b.f. in 1917 to 250,000,000 b.f. in 1920. Since that time the rail shipments have greatly increased and an all water movement via the Panama Canal has developed to such an extent the volume jumped from 1,000,000 b.f. in 1923 to 60,000,000 b.f. in 1927. Mr. McLachlan concludes that the total movement will aggregate, on the completion of the proposed waterway to about 400,000,000 b.f. or 800,000 tons per annum.

The present rail freight rate (April 1928) on lumber y from Vancouver to Toronto is \$29.25 per M.B.F. Ocean freight rates on this commodity via the Panama Canal from British Columbia to Montreal during 1927 ranged from \$12 to \$15 per

M.B.F. The rail haul from Montreal to Toronto plus transfer charges at the former city is \$8.25 per M.B.F. This shows a saving of approximately \$6 to \$7 per M.B.F. in the present all-water movement to Montreal plus rail haul to Toronto over an all rail haul from Vancouver to Toronto.

The saving in transportation costs effected by the St. Lawrence Deep Waterway will be represented by the saving in cost of a transfer at Montreal and the difference between rail and water transportation between Montreal and Ontario points. The cost of the transfer at Montreal may be taken at \$1.75 per ton, while the saving in rail transport will be about \$1.25. This means a saving of about \$3 per ton annually on 800,000 tons or about \$2,400,000 per annum. X

The importation of anthracite coal from Great Britain has been continuously increasing in the past six years with the exception of 1926 when the British miners were on strike. The imports at Montreal on British coal were in 1922, 118,000 tons, and the total imports of coal from Britain to Canada were 183,000 tons. In 1927 the former increased to 683,000 tons and the latter to 798,000 tons. Thus approximately 80 per cent of the total British coal imports are received at Montreal. At the present time the rail haul from that city to Toronto is prohibitive. It is expected that the deeper waterway will facilitate this trade to Toronto and other Ontario points. It is estimated

that about 800,000 tons will move through the waterway. The saving in transportation costs on coal will be the transfer y at Montreal plus the difference between the rail and proposed water haul. Estimated at \$2.50 per ton we have an annual saving of \$2,000,000 on this product.

The natural growth of the West will mean a larger ✓ importation of general merchandise both from western Canada and the United Kingdom. The exports of manufactured goods from Ontario will increase. The increased demand for fertilizers in western Ontario may mean the development of a larger traffic, the volume of which cannot be estimated. From an examination of the imports and exports of such goods into and from Canada, Mr. McLachlan identifies a westward movement of at least 1,000,000 tons on which \$2.50 per ton would be saved and an equal volume of east and west movement in which 50 cents per ton would be saved. This totals to an annual saving of \$3,000,000. This calculation however discards the fact that the western provinces are anxious to increase their own manufactures and to stop purchasing from the east as much as possible.

The total therefore tangible benefits that the St. Lawrence waterway will provide for Canada over what she already enjoys is valued at \$15,000,000. x

We can see for ourselves, therefore, on what the alleged advantages of the St. Lawrence are based. At best,

they are only estimates by acknowledged authorities on the subject who have given the project years of time and thought in study.

From past experience we know that estimates have been inaccurate by vast sums. The average inaccuracies of estimates on the cost of constructing public in the past has been 100 per cent, more or less. The existing canals when first constructed cost several times more than was estimated. Indeed the work on some of them had to be suspended because of lack of funds to meet the unforeseen charges. A case in point is the Welland Ship canal, though the Great War is blamed for the more than doubling of its cost. If, therefore, estimates on cost of construction have proven false, how much more so must estimates in a tangible form be? I leave it to the reader.

Having discussed the more reasonable navigation benefits of this scheme, we shall now deal with those that will accrue to Canada as a result of the power development on the St. Lawrence river. Over two million horsepower are available in the international section of which one half is Canadian. There are another three million entirely within the province of Quebec on this river. The St. Lawrence is estimated, therefore, to be capable of yielding five million horsepower of which four is Canadian property.

Here is a source of wealth that Canada has not taken

advantage of in the past. Here is power which, if properly utilized, would save annually millions of dollars in coal. The Canadian railways need not spend the millions that they have been spending to provide the dirty, sooty service they are rendering. Electric power is cheap, considerably cheaper than coal, more efficient and much cleaner. What the railways need is to electrify their lines in Quebec and southern Ontario. In these provinces they require to render fast, reliable and cheaper service. The amount that power would save them in their coal bills would be ample to justify this transformation. True, it involves the scraping of a great deal of useful equipment, but this change need not come at once. It must be a gradual process, as rolling stock becomes more or less obsolete to discard it and in its place, to instal the more efficient and cheaper operating electric locomotive. Here then is one benefit that power has in store for Canada.

It is only too true that Canada cannot use all this available power at once. The existing power plants, on the St. Lawrence, Niagara Falls, Saguenay, St. Maurice, Ottawa and other rivers adjacent to or within the three hundred mile zone, an area within which power developed on the St. Lawrence can be economically distributed, provide ample power at once. Let us develop it gradually. As we do so the external economic advantages that cheap power offers coupled

with those of the deep waterway will influence vast foreign and Canadian capital to locate in this haven of profit-making. What more could industry ask for. Here is provided a cheap waterway, yielding transportation facilities second to none on the American continent. Through this deeper waterway the raw materials of the world will be collected at low transportation costs, and fashioned into manufactured articles by cheap electric power. Around this area are populous centres capable of acting as labour and consuming markets. New York's the world's money market proximity provides all the financial facilities that industry could ask for. Montreal, another financial metropolis, is nearer still to see that industry's financial requirements are met. Surely industry cannot ask for more. Indeed, so great are the advantages that it is expected industries already established elsewhere, will forsake their old abode and locate in the St. Lawrence basin to partake of the economic advantages that nature has so amply provided.

Canada, as I have mentioned previously, is the second largest power producer in the world. Considering our potential power possibilities we are first. Out of the four and a half million horsepower approximately seven-nineths were produced in the two most industrialized provinces of Canada, Ontario and Quebec. In 1910 Quebec produced 335,000 h.p. and Ontario 490,000 h.p. In 1915 the former produced

800,000 h.p. and the latter 870,000 h.p. in 1920 they each produced 950,000 and 1,055,000 h.p. respectively: in 1925 they produced 1,750,000 and 1,785,000 h.p.; while in 1926, Quebec surpassed Ontario by producing 1,915,000 h.p. and Ontario 1,790,000 h.p. Out of all this we export annually about 500,000 h.p.

Do not these figures speak for themselves? What better proof do we want of the popularity of electric power in these two industrialized provinces, who are in their initial stages of their development? During the years 1924 and 1925, installations of over one million horsepower were made, including both new construction and the erection of new turbines and generators in existing water power stations. At the present time there are large new developments either in course of construction or actively projected. There is every indication that the development of water power in these two provinces will make continued progress in the future.

From these amazing developments that have taken place in both provinces we find that there is enough power developed to take care of their needs for the next five years. In addition should both provinces require more power they can easily get it from other sites within their borders without touching the St. Lawrence. But these other sites are not as likely and with a deep St. Lawrence waterway, do not offer

the external economies that power developed on that river would. Gigantic power interests are fighting at the present time (March 1929) for power rights on the St. Lawrence. Both of these forces are the most respected and feared in Canada. One of these, the International Paper Co., developing 803,000 h.p. in different parts of Quebec, and the other the Holt-Gundy Interest are reputed to be combating for the power resources of Quebec. Quebec, one might say, is a private ownership community, while Ontario is essentially a public ownership province. The Hydro Electric Commission developed along over one million horsepower in 1928. In addition, it purchases power by contract from private corporations such as the International Paper Co. at its Gatineau River plant.

These two corporations envisage the power possibilities of the St. Lawrence and are determined to get the power rights. The International Paper was originally in the pulp and paper industry but its power requirements demanded that it should enter in power development. Experience and sagacity have taught it that though additional power may not be needed at present in the two provinces, it shall in the very near future. The Holt-Gundy interests are of the very same opinion, and would apparently jump at the opportunity of getting the power rights of the St. Lawrence. But these rights of the St. Lawrence cannot be disposed of, unless it

is by the combined consent of Canada and the United States.

It is logical to conclude then that at least the one million horsepower offered in the international section will be gulped within a short time after it becomes available.

In the Journal of Electricity of June 1921 was an authoritative calculation of the definite correlation between the amount of electric power newly developed and the average of new employment that would result from it. The units of 1000 h.p. being taken, a total of 385 new employees would result from every 1,000 h.p. developed. Assuming that one workman supports a family of five including himself, 1,000 h.p. would really support 1925 people.

If we assume as it is logical to, that the 1,000 h.p. will be consumed by Canada as soon as it becomes available, that means that an additional 1,925,000 people will be supported directly through new power development. When Canada utilizes the other 3,000,000 h.p. in her national section, a total population of 7,700,000 would be supported by the development of this power. The development then of power alone will support an additional population of over seven million people. Their wages all paid for out of the utilization of power. This utilization of this additional power will, of course, be gradual. The St. Lawrence Waterway advocates do not ask that all the power be developed at once; that must be gradual. But they do say that power

will not be utilized to the same extent on the St. Lawrence unless there was a deeper waterway that would yield transportation advantages to industry. The destructive characteristics of modern industrial life is its dependence on plentiful supplies of electrical energy coupled with the accessibility to raw materials, labour and consuming markets.

The power could be generated in instalments quite profitably. A few years would elapse before all the power is required but that would be rapid. It is claimed that American concerns at this very moment are prepared to locate in this vicinity of Canada and to utilize 300,000 horsepower. The Aluminum Company on the Saguenay will require more than that quantity.

The proponents of this scheme claim further that the industrial development of eastern Ontario has been held back for decades by the lack of a plentiful supply of power. The Hydro contract for the purchase of 250,000 horsepower of Gatineau power will expire by the time the St. Lawrence project is completed. This contract has served a valuable purpose by providing 100,000 h.p. to eastern Ontario and at the same time by developing that market. It is anticipated that within the next ten years, western Ontario's demand for power would have increased by 600,000 horsepower.

It must be recalled that the international section is entirely between the province of Ontario and New York State.

The power therefore developed here will be equally distributed between the province and the State. That the million horsepower in this section will be needed by Ontario cannot be doubted when the above considerations have been understood. It is a commonplace that Ontario obtain large quantities of coal from the States. The saving that the substitution of electricity for coal would be enormous, when we consider that 500,000 horsepower of electrical energy is the equivalent of 3,000,000 tons of coal. There is no doubt that Ontario needs that power and can utilize it advantageously when it gets it.

The greatest factor in transportation in Canada in the near future will be the electrification of our railways, hydro-radials and radials as a whole. These electrified lines can act as feeders to the main steam roads. In the West it is expected that sooner or later we will have a net work of electrical lines. The time is not yet ripe but it will surely come. These electrical lines will serve rural municipalities and urban centres as they are now doing at Detroit, Cleveland and Buffalo, as well as at many other American localities.

Suburban service which now exists only in a few places in Ontario and Quebec, could be extended through the St. Lawrence power development. Farms which act as the immediate hinterlands and in conjunction with different cities as an

economic entity lack this necessary service because of the great expense involved in steam service. Now with the greater supply of electricity, various communities would receive this suburban transportation and communication service to the benefit of all. With such a system we can have eastern, western and particularly northern Ontario which is suffering as a result of the lack of proper transportation facilities rich and prosperous communities.

The poverty of the people in northern Ontario and western Quebec is largely due to the lack of transportation facilities. They grow their vegetables and other farm products. They have poultry, eggs, etc., but find it impossible to sell them to the populous markets of Ontario because of this handicap.

CHAPTER 5.

GENERAL CONSIDERATIONS

Despite the efforts of the promulgators of the St. Lawrence deep waterway scheme, there are many objections that prevent its immediate execution. These difficulties, of course, all emanate from the opponents of the scheme. It is the aim of the writer in this short work to bring forth the most important arguments for and against the plan and in that way manifest to his readers the exact merits of the waterway.

One of the most important points on which disagreement centres is the probability of ocean vessels ascending to the head of the lakes. The proponents of the project, both American and Canadian, are certain that such would be the case. The opposing forces claim that the waterway would be too restricted and that therefore ocean boats would not go past Montreal, that the insurance rates and risks involved would be too great, that the cost of operating an ocean vessel of similar size to a lake boat is considerably greater, that the construction costs of an ocean boat are three times greater than the lake freighter, and that therefore these boats would not be able to compete successfully with lake freighters. Nor would the lake boat be able to go past Montreal for its construction has designed it for

lake service, which is not as hard on vessels as the ocean. Should it venture out into the ocean, the Atlantic waves will certainly break it up. This contention is based on the theory that since lake waves are half the size of ocean waves, the freighters operating on the lakes need not be as strongly constructed as ocean boats. To obtain this extra strength, carriage capacity is to be sacrificed. Let us deal with these in order.

The proposed St. Lawrence waterway, if built along the lines recommended by the Canadian section of the Joint Board of Engineers in their report of 1926 will have nine locks between Montreal and Lake Ontario. The locks will be 850 feet long between grain posts and 100 feet wide with a depth of water 30 feet on the sills. The total distance from Montreal to Lake Ontario is 183 miles. The clear width of the channel provided will be for canal and lock approaches 200 feet for 12 1/2 miles and 350 feet for 10 miles; while for subaqueous channels the clear width will be 500 feet for 6 miles, 600 feet for 4 miles and over 600 feet for 140 miles. The Welland ship Canal will be 26 miles long with eight locks of the same dimensions as the St. Lawrence canals with a minimum width of 200 feet. Comparing this canal system with others in different parts of the world, we find a convincing argument for the waterway, though it is admitted that it cannot be compared in all respects with

other similar undertakings.

The Manchester Ship Canal, connecting that city with the Mersey river near Liverpool, is 35½ miles long, 28 feet deep and has a minimum width of 120 feet, except near Latchford where for three quarters of a mile it is 90 feet wide. A difference in level of 70 feet is overcome by five locks, 600 feet long and 65 feet wide. The radius of curvature provided on our waterway is about 50 per cent greater than that in use on this canal. The traffic through this canal in 1925 was 5,381,691 tons. The rail haul saved is only 35 miles yet it has been the cause of making Manchester a great city and has provided enough external economies to enable industry to settle there. It was said of this canal that ocean boats would not go up to Manchester but this objection proved false, despite the fact that it is considerably more restricted than the St. Lawrence project will be. Another canal similar to the Manchester one is the Amsterdam Canal which connects the North Sea at Ymuiden with Amsterdam and Zuider Zee. It is 17.4 miles long, 165 feet wide with a depth of 32 feet. There is one lock 722 feet long by 32 feet wide. This canal which is used extensively places Amsterdam on a competitive basis with Rotterdam.

The ports of Rosario and San Lorenzo on the Upper Parana river are 245 miles above Buenos Aires by water. The

depth of the river varies from 22 to 25 feet depending upon the season. The channel has very many sharp curves; yet fifty percent practically of the wheat exports leave these ports despite the fact that Buenos Aires is only about 185 miles distant by rail. If ocean vessels ascend this river with its shallower depth and comparatively treacherous banks, will they not navigate the deeper St. Lawrence past Montreal, with its restricted channel of only 45 miles and open waters clear through to the head of the lakes. The Panama Canal is about 40 miles long. There are six double locks with a length of 1,000 feet, width of 110 and depth of 11 feet on the sills. The width of the canal prism is 300 feet for 8 miles. The tonnage that in 1916 was a little over three million, was in 1926 over twenty-six million.

According to Mr. McLachlan of the Railways and Canals department of Ottawa, there are great lengths of restricted water on many routes now used by ocean ships. Boats trading with Asiatic ports often have to go up restricted channels longer than those on the St. Lawrence route. On many other important channels there are bends considerably sharper than those on the St. Lawrence. The channel leading to the great port of Antwerp has a curve twice as sharp as any on the St. Lawrence.

If ocean boats can afford to pay the higher insurance rates and take the greater risks involved in other restricted

channels, surely they shall not be hindered from ascending the St. Lawrence with its comparatively fewer dangers. That insurance companies charge considerably higher rates on this route than on the ocean is not to be doubted. But the lake freighters have to bear them just as well as the ocean tramp; so they are on a fair competitive basis in this regard.

As to operating costs, Mr. McLachlan, who is an authority on the subject and a member of the Joint Board of Engineers, has worked out the relative operating costs per day of a 2,400 ton lake boat, an 8,500 ton ocean tramp and a 12,000 ton lake freighter. His findings do not bear out the contentions of the opponents to the scheme. The same is true with regard to cost of construction. It was found that the cost of the tramp as built in English shipyards in 1913 varied from \$32 to \$35 per ton, while the cost of the bulk lake freighter built in the Great Lake yards in 1913 was \$37 to \$41 per ton dead weight carrying capacity. As the present cost of building ships is 60% above pre-war cost, the above given costs work out to be \$56.50 per ton for the 8,500 ton ocean tramp and \$62.50 per ton for the 12,000 ton lake freighter. The cost per ton for the 2,400 ton lake boat, or what is known as the canal sized boat the cost is \$79 per ton. The information on costs was obtained from various shipbuilding concerns, in the United Kingdom, the United States and Canada, as well as from the Canada Steamships

Company and the Canadian Merchant Marine, who furnished data as to operating and maintenance costs. A table is given below for the purposes of comparison between the three different types of ships. It reveals quite a few points of interest. Taking the 12,000 ton lake freighter as the unit of capacity, we find that the canal sized boat has a capacity of .20 and the ocean tramp .71 of the lake freighter's capacity. If the cost of construction of each boat is in the same ratio, then as far as this element is concerned they are on equal competitive basis. This ratio we find to be .25 and .64 of the cost of the 12,000 ton lake freighter. From this we observe that the tramp is placed in a more favourable position than the lake freighter used as the unit of basis, and the canal sized lake boat in a relatively less favourable situation. Finally, considering the total expenses per day as given in the table below, we come to deductions that are still favourable to the tramp in so far as its power to compete with the large lake freighters is concerned. These expenses for the canal sized boat are .35 and for the ocean tramps .67 of the lake freighter. Though the tramps capacity is .71 of the lake freighter's its daily expenses are but .67 and its cost of construction but .64 while the small 2,400 ton lake boat's capacity is .20, its daily expenses are .35 and its cost of construction .25 of the unit ship.

TABLE SHOWING CHARACTERISTICS AND PERFORMANCES OF SHIPS

	Canal Size <u>Ship</u>	Ocean tramp <u>8500 ton</u>	Lake <u>Freighter</u>
Deadweight carrying capacity	2,400 tons	8,500 tons	12,000 tons
Length	253 feet	430 feet	600 feet
Beam	43 "	54 "	58 "
Depth		24.4 "	
Draft	14.2 "	24.0 "	21.0 "
Gross tonnage		5752 tons	8750 tons
Crew	20	40	30
Speed - knots per hour			
Calm weather	10 knots	10 knots	10 knots
Average	9.7 "	9.7 "	9.7 "
Coal consumed per day			
On voyage	16 tons	35 tons	42 tons
In port	2.5 "	5.5 "	6 "
Stores per day			
At sea	8 "	16 "	14 "
In fresh water	2 "	5 "	5 "
Cost per ship	\$190,000	\$480,000	\$750,000
Operating season	230 days	330 days	230 days
Expenses per day - Fixed charges			
Interest	6%		
Depreciation	4%		
Maintenance and repairs	3%		
	<u>13%</u>		
Total of 13% fixed charges	\$107	\$189	\$414
Crew and sustenance	70	132	105
Coal on voyage	80	175	210
" in port	13	27	30
Engine and deck stores	15	33	36
Management	5	14	16
Total expenses per day			
On voyage	277	543	791
In port	210	395	611
	<u>487</u>	<u>938</u>	<u>1402</u>

This analysis leads us but to two conclusions, that is that the small lake freighter that is now used to carry grain from Port Colborne and Buffalo to Montreal and which ~~b~~^e~~a~~rly manages to navigate the existing canals, will not be able to compete with the larger boats when the St. Lawrence waterway becomes a reality; that the ocean tramp of that particular size will be more than able to hold its own against the 12,000 ton lake freighters. In addition, the tramp has the advantage of operating 330 days, or eleven months in the year while the lake boats could only operate 220 or about seven and a half months per year. Surely then under such circumstances the ocean tramps will not hesitate to ascend to the head of the lakes, or anywhere on the waterway where they can obtain suitable cargo.

The contention of the opponents that the lake boats would not go past Montreal is one that the advocates of the project cannot deny. Unless some composite type of a ship is evolved, that will navigate both ocean and lakes and that can conveniently displace the lake freighters, these will only descend as far as Montreal. There they will transfer their cargo to ocean boats and return back with as much cargo as they can get. The large size of the lake freighter and its relatively shallow draft, enables it to navigate inland channels with greater ease. This is considered as an inherent advantage that shall enable the freighter to success-

fully compete with the tramps.

Various alternative routes have been suggested as being better than the proposed route. All of these alternative routes have been largely instigated by national prejudice more than by essentially economic motives. Some of these may in time be required as complementary routes to the St. Lawrence but for the present at least after their merits and defects have been thoroughly discussed, they have all but one been rejected as being inferior to the St. Lawrence route.

The Hudson Bay route has occupied the minds of western Canada for some years. The value of this route to the West has been dubious from its very inception. The short and uncertain navigation period renders freight uncertain. The ice infested regions of the Hudson Straits render ocean service costly. However, a railway nearing completion is being built by the Federal government expecting to have as its terminus Port Churchill on the Hudson Bay. The mileage saved in the railway haul from western points is insignificant as compared to Port Arthur. The originators of this scheme had hoped that this would prove a considerably cheaper route than the St. Lawrence waterway. They were primarily concerned with getting their grain out to the world's markets at lower transportation costs. As this road is nearing completion, the West's zeal for the St. Lawrence waterway has

subsided. The western provinces would still like to see it undertaken but they are at present looking forward to the inauguration of the Hudson Bay route that shall test its economic soundness.

The West at the present time is too greatly preoccupied with the Hudson Bay route to cause any active agitation in favour of the St. Lawrence. The benefits which the S. Lawrence offers to Canadian farmers are anticipated in the Hudson Bay scheme. Why should they preoccupy themselves with a scheme that requires ten years before it yields its fruit when the Hudson Bay railroad that shall open the western grain to the world's markets is so near completion.

So the western tributary area though it would still like to see the St. Lawrence development is ^{not} now so keen as formerly. Not so with the American western states; they are as keen and even more anxious than formerly to see the project of the Great Lakes put into execution.

All other deep waterway projects have been rejected either as being too costly or impractical. The Georgian Bay Canal system, and the Oswego-Albany route were at one time formidable opponents of the St. Lawrence project. Both, however, have been considered as too costly. It is worth while noting that the former is a totally all Canadian scheme and the latter entirely American. Even at the present time the

latter route is used as a threatening argument by St. Lawrence Waterway advocates. They have grave apprehensions that if Canada doesn't cooperate immediately with the United States, the latter might find it advisable to commence operations on the All American Oswego-Albany route. That the great republic would undertake the building of this route is doubtful as not only are the costs considerably greater, but the waterway itself would be inferior and more restricted than the St. Lawrence.

Indeed, the United States need not go to the expense of construction^{of} such a waterway. Should the St. Lawrence project not materialize then by 1930 the big lake freighters will be bringing their cargo down to the foot of Lake Ontario, either at Prescott or Kingston or other near by Canadian ports, or at Oswego on the American side. Here of necessity they must transfer their cargo either to the Canadian railways or to smaller canal boats, or else transfer them to American railroads. The former would take their cargo to Montreal and the latter either to Albany on the Hudson River or else direct to New York. Herein lies a disadvantage to Canada and particularly to the port of Montreal. If the St. Lawrence were deepened, then traffic would go right up to that city, but if left in its present state, a great deal of the traffic would seek the American route. Albany then would rise as an active competitor of

Montreal. Our apprehensions should be further aroused when we know that the American government is actively engaged in making Albany accessible to ocean shipping.

The full benefits of the new Welland Ship Canal cannot then be realized until the St. Lawrence is made accessible to large boats. As it stands, it would be as if we were spending capital to improve the trade of American rather than Canadian ports.

Opponents of the St. Lawrence waterway are primarily in the New England States, Quebec and British Columbia. The most formidable ones are those of New England, particularly New York. Quebec, that was originally hostile to it, is gradually losing its antagonistic attitude and assuming a more favourable position.

The very apprehensions of the hostile forces, lead one to deduce that the advantages attributed to the waterway by the advocates were more real than imaginary. The states most likely to lose were of course New England and New York. These up to the present are protesting of the injury that shall be done to America's metropolis should the St. Lawrence project materialize. New Yorkers insist that it is a national duty to build up and conserve the interests of the great commercial capital of North America and declare that the St. Lawrence canal would be little short of a national calamity.

Apparently it is the belief of even the opponents to the

scheme, that condemn the waterway as a gigantic piece of foolishness, that the St. Lawrence will divert a great deal of traffic that now goes by the Atlantic ports.

New York State wants the power and would be only too willing to develop it but it refuses to cherish the St. Lawrence waterway.

British Columbia ports, because of the development of the export grain trade via the Pacific are similarly opposed lest part of this traffic be rerouted by way of Fort William.

Quebec, like New York, is greatly interested in the development of power but unlike the latter it is not so hostile to the waterway. Formerly, under the leadership of Montreal, Quebec province was very antagonistic. But when the merits of the project were discussed from all angles it was ultimately concluded that Montreal would still remain Canada's metropolis. The attitude of the Montreal Harbor Commission is instructive in this respect. Mr. T. W. Harvie, general manager and secretary of the Harbor Commissioners of Montreal, when asked before the senate whether the deepening of the St. Lawrence channel and river would increase or decrease the business through the port of Montreal, gave the following reply. "I think the deepening of the St. Lawrence channel and river would increase the business, because the improved channel would then mean bigger ships and therefore cheaper transportation both below and above Montreal. The

size of ocean vessels coming to the port is steadily increasing there being at the present time passenger liners of 19,000 tons, 20,000 tons gross register; in addition to that there are freighters capable of carrying 12,000 to 14,000 tons of cargo." It is Mr. Harvie's opinion that only a few small tramps of about 8,000 tons will ascend beyond Montreal. It is believed that with a deeper channel to Montreal of from 35 to 40 feet, that city shall attract some of the largest liners and tramps of the world and these naturally would not be able to navigate the 27 or at most the 30-foot canals. Commerce of the modern world is demanding the larger freighter by reason of its greater economies of transportation. These would not be able to pass Montreal and even the 8,000 ton tramps would find it uneconomical to ascend the lakes. The large lake freighters, therefore, according to Mr. Harvie's opinion would come as far as Montreal and there discharge their cargo, while the ocean vessels would similarly unload their stores. The port of Montreal would be the transferring medium between ocean and lake traffic and vice versa. Mr. Harvie finds the St. Lawrence Waterway project an efficient economic transportation route. He adds "In my opinion, Montreal will always remain the head of ocean navigation. Although it is a thousand miles up the St. Lawrence route, the most economic route on the continent, it is a little closer (300 miles)

than its most formidable rival, the port of New York. That governs the distance the ocean ship must go. I have been told by experienced shipping men that a ship is only making money when it is going at a fair speed with a fair cargo. The moment it is lying at a dock or is delayed for any cause whatsoever, it is losing money. Any trading ship will go to the nearest competitive port where it will get the shortest turn around. There is no port in the world where you will get as short a turn around as at Montreal and the competitive distance with its biggest rival, New York, is favourable." He concludes "I have had to do with the building of the port of Montreal in one capacity or another for twenty years and all the officers and commissioners I have served under always anticipated a deeper waterway as far as I have been able to judge, and I would say the report of 1920 bears that out it probably was not a concrete fact, but as far as I know, everybody considered it an inevitable development following the deepening of the Ship Channel."

Let us hear what Mr. A. L. MacCallum, manager and secretary of the Shipping Federation of Canada said before the Senate last year. "This association is a Canadian Association of steamship owners and agents interested in the ocean shipping trade to the St. Lawrence and to Canadian Eastern ports. Its membership does not include inland vessel

owners or operators. The aims of the Federation are to safeguard the interests of its members in connection with aids to navigation, channel and harbour depths, harbour facilities, pilotage, tonnage port charges, etc. In 1921, when the question of the St. Lawrence Deep Waterway Project was under discussion, the Federation strongly opposed the construction of the waterway on the grounds that from a navigational standpoint the expense to Canada was not justified and that the building of such a waterway jointly with the United States would lead in the long run to loss of sovereign rights by Canada.

The Federation claims that in its attitude towards the proposed waterway, it is not actuated by any spirit of factious opposition to further S. Lawrence improvements. Its members represent regular line and tramp vessels which trade not only to Quebec and Montreal, but to St. John's, Halifax, Vancouver, Portland, Boston, New York, etc. The ocean carrying trade is not wedded to any particular ports hence it cannot be claimed that the attitude of this Federation is based on any local interest in the ports of Montreal and Quebec." By way of explanation, I might say that Mr. MacCallum's attitude is typical of one kind of opposition to the waterway. It is based, not on any apparent selfish motives but rather in the light of knowledge and experience. Just as the exponents of the waterway believe that certain benefits

will result to Canada by its operation, so these opponents believe that it is not time for our country to undertake an enterprise of so vast an importance and which may have dire consequences for us in the future. These opponents are merely saying, stop, look and listen before you act. They admit many of the alleged advantages of the St. Lawrence project but they qualify their statement by saying that the so-called advantages of the project are theoretical; that proponents of the scheme are merely building castles in the air and at the same time involving the country into great expenditures that may prove an unwarranted burden upon the people. Why must we stop, look and listen? Mr. McCallum answers: "The immense Canadian expenditure involved in the undertaking can be justified only by commensurate benefits to this country. The existing St. Lawrence canals are used and any new waterway would be used by Canada mainly as a channel for the movement of export grain. During 1926, 96% of the Canadian through traffic eastbound on the St. Lawrence side canals, consisted of grain. It cannot be questioned, therefore, that the basic importance to our country of the St. Lawrence route between Lake Ontario and Montreal is that it provides an outlet to the Atlantic sea board for North west grain. The utilization by Canada of the existing waterway for the movement of grain so far exceeds her use of it for all other purposes combined that the proposed expenditure or in-

provement of navigation could only be justified by reductions in the cost of grain transportation commensurate with the cost of the undertaking."

Mr. MacCallum quite rightly continues: "Extravagant claims have been made, principally by American proponents of the scheme, as to heavy savings, in grain rates from the head of the Lakes to Europe which would result from the building of the proposed waterway. These claims vary from 5 to 10 cents per bushel and undoubtedly much of the American sentiment in favour of the waterway has been built up on the supposition that if the waterway were built, the farmer of the Middle West and by influence the farmer of the Canadian West, would save approximately 10 cents per bushel on the carriage of his grain from the head of the Lakes to European markets. This saving, it is claimed, would be effected by the ocean vessel, which, instead of terminating its voyage at Quebec and Montreal as at present, would proceed direct to ports on the Great Lakes such as Chicago, Duluth and Port Arthur, there loading full cargoes of grain and carrying same direct to the European market."

Mr. MacCallum's statements above are not disputed, but as an impartial witness on the St. Lawrence waterway project, he seems to me to have attacked the exponents too severely, on a point that has been discarded by the proponents themselves after discovering its fallacy. No proponent of the scheme who

has studied his subject expect a saving of greater than three cents per bushel.

He adds: "The Federation has given special consideration to the possibilities of ocean vessels proceeding beyond Montreal to Great Lakes ports through the proposed waterway.

It has no hesitation in saying that the regular passenger and cargo liners, that now terminate their voyages at Quebec or Montreal, would not use the waterway even if it

were built. these vessels when fully loaded would not be able to pass the 27-foot channel proposed.

..... further dangers of manoeuvring liners in and out of locks, high operating costs in restricted waters, and the scarcity of high class freight to and from Canadian lake ports would preclude the successful operation of this type of vessel through the waterway."

But advocates at the present time do not for a moment believe that liners would go beyond Montreal. They are well aware of these objections and concur with this.

Let us continue with Mr. MacCallum's arguments since they are representative of opposing theories. He remarks further: "In our opinion the only ocean-going vessels which could or would use the proposed waterway, are transient or tramp vessels carrying bulk cargoes. The smaller vessels of this type which now load full cargoes of grain at the ports of Montreal and Quebec, could navigate

to the head of the Lakes, load a full cargo of grain there and proceed direct to European ports. Only a proposition of the tramp vessels carrying bulk grain from Montreal to Europe during the past season of navigation could, however, when fully loaded, utilize a 27-foot channel between Montreal and Lake Ontario. The benefit of the waterway to the Canadian West would therefore be confined to the saving that such vessels would effect by a direct carriage on the present all-water rate from Port Arthur to Montreal and thence to Europe, as modified by improvements in navigation and transfer facilities now under way."

So far Mr. MacCallum has said nothing that the advocates of the deeper waterway did not state. But he mentions a point in the following paragraph with which we can all agree. He continues: "It seems to have been overlooked by many proponents of the deep waterway scheme, that the ocean tramp does not confine its activities to any particular port or route. It seeks the most profitable trade and the shipper at any specific port has no guarantee that tramp tonnage will offer itself in sufficient quantity and at a rate favourable to the shipper whenever the latter is ready to export. rates for cargo space are governed by the law of supply and demand.

"To meet the extra expense and risks involved in proceeding beyond Quebec and Montreal to and from the head of

the Lakes, the tramp vessel would have to secure a higher proportionate rate for the inland haul than is now charged by this class of vessel for ocean transportation from Montreal.as compared with all-water existing rates via the St. Lawrence, calculations show that there would be a saving of from two to three cents per bushel; the very short period during which grain could be moved by ocean vessels direct from the head of the Lakes, and the dependence of tramp rates and supply of tramp vessels on world wide traffic conditions would necessarily be reflected in the actual rates."

Here again we must offer an explanation. The proponents primary purpose is to have a deep waterway that shall enable the majority of ocean vessels to ascend the St. Lawrence and to navigate the Great Lakes, if they so choose. They do not for a moment cherish the idea that all the ocean boats shall be able to pass their proposed canals. According to Lloyd's Register of Shipping 1924, ships built in the period of 1913-24 and still afloat in 1924 registered 53.8% of the total. Their average or approximate draft was 25.8 and under. While 85% had a draft of 26.7 and under with a gross tonnage ranging from 100 - 8000 tons. Of this last percentage, 69% has a tonnage of from 2000 to 8000, of the total. While 49% of the total

tonnage built in the twelve leading countries of the world and still afloat in the period 1913-24 has a tonnage varying from 4000 to 8000 tons gross register and a draft ranging from 24.5 to 28.7 feet and 24.6% of total have a tonnage ranging from 4000 - 6000 gross register and a draft of 25.8 or less. Now the proponents of the waterway are well aware that the supply of tramp vessels will depend on vicissitudes of world trade and that the rates will accordingly fluctuate. But this is common experience with all the ocean ports and the primary purpose of the deep waterway is to transform our bordering lake cities and towns into ocean ports. What makes these places ocean ports is accessibility of the world's ocean vessels to them. It is not expected nor is it claimed that a definite percentage of this ocean tonnage will seek business on the Great Lakes. They emphatically assert, however, what the above figures manifestly reveal, namely; that the greater proportion of the world's ocean tonnage will have access to these inland ports, with the deeper waterway. As it is should trade one day increase as to demand increased transportation facilities on the Great Lakes, supply of ships would have to come from the great lake transportation companies. They would have full control. Should ocean boats desire to come in to relieve the tension and partake of the prevailing higher profits they would be prevented by the shallow depth

of the canals. Even if tramps did not ascend the lakes, with a deep waterway potential competition would prevail to keep rates low. In 1927 there were about twenty small Norwegian boats that could navigate the 14-foot canals taking part in this trans lake-ocean trade and in 1928 the number doubled. In spite of the shallow canals we have some ocean craft navigating our lakes, will they not do so to a greater extent when our inland ports become accessible to the majority of the ocean ships.

However, Mr. MacCallum is within reason to bring to light these limitations to the waterway, as most proponents tend to neglect them. He states farther on: "Our present waterway which is an extremely valuable Canadian asset is admitted to be the cheapest of all means of transportation between the middle western states and the Atlantic sea board. It effectively serves the existing Canadian trade and is of a capacity to meet our requirements for years to come..... It is somewhat surprising, however, that as the present waterway provides the States with the cheapest route to and from European markets, this route has not been utilized to greater capacity by the American territories tributary to the Great Lakes in spite of the fact that American vessels can make use of the entire system free of canal tolls.

"It is o r firm conviction that so far as Canada is concerned the project is untimely and premature. Before the war we expended very large sums on development of railway transportation facilities far in advance of the needs of our population, and thereby saddled the country with a heavy burden of debt, which we still carry. This Federation is unalterably opposed to international control of Canada's only outlet to the Atlantic, and firmly believes that the National waterway policy under which Canada has brought the existing entirely Canadian waterway system on the St. Lawrence to its present efficient state at a cost of many millions expended over a long period of years should be continued. The Federation contends that an impartial study of the economic situation discloses that the present all-water system via the St. Lawrence offers not only an efficient but the cheapest route to Europe for the produce both of the Canadian and American West; that this present route can be utilized to greater capacity and its facilities further improved at moderate cost; that as and when her economic developments requires and her financial position warrants, Canada should make further improvements as a purely national undertaking."

Let us ere do a little explanatory work in order to realize the force of the above assertions. In 1926,

Canada exported 349,000,000 bushels of wheat and the United States 274,000,000. Because of existing transportation rates and facilities a great deal of the American wheat is claimed by the Gulf of Mexico and Pacific coast ports. In so far as this wheat finds it advantageous to export by these respective ports it cannot be said to be tributary to the Great Lakes route. The exports from ports on the St. Lawrence river and Canadian Atlantic as well as American Atlantic ports as far as Baltimore, were 298,000,000 bushels, of which our ports handled 209,000,000 bushels, and the American 89,000,000 in 1926.

A great deal of the grain is exported during the winter months as Europe requires grain continuously. In the seven months of open navigation the quantity that left Canadian and American N. Atlantic ports was 131,000,000 and 68,000,000 bushels respectively. We can deduce from this how much moves during the winter months. There is also a westward movement of wheat via Vancouver ranging from about 25,000,000 to over 70,000,000 bushels per annum. All our eastward moving grain practically is exported through American ports, but the bulk of the eastward moving American grain moves out of Canadian ports. The explanation for this is that our grain ripens late and is shipped in volume in October and November, and naturally the owner is desirous to market it quickly, so he

directs it to Buffalo. On the other hand, the United States grain ripens to the west of Chicago in midsummer and is delivered to Lake Michigan ports. Our boats at this time are not particularly busy while the United States vessels are occupied with the carriage of iron ore; and since no Canadian grain is available they turn to this American grain which they haul to Port Colborne and Georgian Bay ports. This action has a tendency to transfer this grain from American channels and to fill up the slack period in midsummer, at Montreal and Quebec. Because his grain ripens early the American exporter is not worried about having his grain easily accessible for winter shipments. Why Americans do not utilize our canals to a greater extent with regard to grain is self-evident. It is predicted that America shall play a less important role in the export of grain in the near future. The fact that most of the American grain seeking the I. Atlantic route, does go by way of our canals eradicates the significance of Mr. MacCallum's observations.

He maintains further on that when the proper time comes Canada should undertake the development of the waterway on a purely national basis. There are a great many people who have similar notions. They believe that a purely national development is the best solution to the problem. It is feared that a joint action with the United

States portends evil for the future of Canada. With this matter I shall deal in a subsequent chapter. Suffice it to say here that as the waterway exists at the present moment is not an entirely Canadian one but a joint one. At Sault Ste. Marie there is a canal on the Canadian side and three larger and more efficient ones on the American yet all are used freely by both nations. The channels connecting Lake Huron and Lake Erie there are artificial structures that meander along the international boundary. In certain sections it would be impossible to pass without navigating in American waters for miles. Though appropriate all Canadian channels are possible throughout the waterway system according to the joint board yet the expenditures would be tremendous and unwarranted.

The problem of return cargo has not yet been settled. It is maintained that though boats may find cargo from the head of the lakes to Liverpool, they must return in ballast since there would not be anything to bring back. However, as I have illustrated previously, the advocates believe that there is and have given definite examples. The prevailing conviction seems to be however that for every five loaded vessels that will descend the waterway, only one will ascend it loaded.

Another prominent contention and one held by Mr. Lefebvre, another Canadian member of the three on the Joint

Engineering Board, is that the traffic on the Great Lakes consists primarily in the order of their tonnage importance, of Lake Superior iron ore, coal, crushed stone, grain and general merchandise. All except the last is bulk traffic. It is his opinion that iron ore will not be transported by way of the improved canals. It is used in the blast furnaces in the Pittsburgh district and in the ports of Lake Erie. The coal is shipped to us from the ports on Lake Ontario. He doubts whether the improvement contemplated will have the least effect on the freight charges for this kind of merchandise. Similarly he doubts that crushed stone will ever be exported beyond the Great Lakes. He opines that grain is the only commodity that may increase the traffic on the Great Lakes. He feels fairly optimistic that this traffic will increase. As to the package freight he considers its development as problematical which no doubt it is, as the whole project is after all a problem seeking solution. The traffic on the Great Lakes in 1926 totalled 121,000,000 tons, of which iron constituted 63,000,000, coal 31,000,000, crushed stone 14,000,000, grain 12,000,000 and the balance package freight.

The maximum capacity of the proposed canals is 24,000,000 tons per annum. The most competent authorities have stated that the alleged transportation cost reduction

may reach a maximum of 3 cents per bushel in the case of grain. This would be the equivalent of one dollar per ton, as a maximum. The maximum that could be saved then would be \$24,000,000 per annum. This is based on the assumption that the freighters would return empty from Montreal.

But as it is now, only about 4,000,000 tons of grain move via Montreal, Quebec and United States North Atlantic ports. If all this traffic were to seek the deep waterway which Mr. McLachlan, the other Canadian member of the Joint Board, considers a reasonable assumption, there would be a saving of \$4,000,000. Here is an incongruity that is difficult to explain. Both of these men were members of the joint board; both agree that a saving of three cents per bushel is a reasonable saving to expect; yet one takes the saving on the ton as one dollar and the other as one and a half. Which is correct no one can say. By way of information we should perhaps mention that Mr. Olivier Lefebvre is also Chief Engineer of the Quebec Streams Commission, Montreal, P.Q. But Mr. Lefebvre lays down his cards in the following statement when he says: "The canals of Canada have been declared to be public works that have been carried out for the greatest advantage of the country and their cost is paid by the whole country. Water power must be paid for in the final analysis by the consumer

of electric current. Now the Government is being advised from certain quarters to deviate from this principle by the following proposal: the St. Lawrence deep Waterway may be carried out without entailing any cost to the country in addition to those expenditures which we are committed to, such as the Welland Canal. It is proposed that as an offset to our expenditures for the Welland Canal and the deepening of the St. Lawrence below Montreal, the United States would be asked to undertake at their own expense the works projected in the International Section of the river both for navigation and power. Canada would take her share of the completed works including half the power..... it is submitted that the producers of the hydro electric power in the national section would be prepared to provide the country with improved navigation free of charge in exchange for the privilege of developing the water power." In this manner we shall have a completed deep waterway project without any further cost to the Federal treasury. He continues: It is nevertheless interesting to ponder for a minute and ask oneself who is going to assume the function of the Federal Treasury..... The canals cannot provide any revenue as they are free. The only source from which the producers of power could derive revenue would be the sale of power.... by the consumer of electric current. This method

would be extremely unfair to the Province of Quebec which would be called upon to pay in the final analysis the cost of an improved navigation that is designed to benefit and is demanded by interests outside the limits of that province."

The incongruity, therefore, is easily explained though Mr. Lefebvre is a member of the Joint Board of Engineers yet his main interests lie within his own province. Here we have another reason why Quebec, which is very anxious to develop its power resources is not so anxious about the waterway. Its people see a doubtful benefit as far as the province is concerned. It will not lose any trade and on the contrary the city of Montreal would gain. But the province sees that the best scheme or the one which is most likely to prove acceptable to Canada if at all, is going to force the province to shoulder indirectly the cost of that part of the waterway which it is estimated would cost about \$90,000,000.

A similar feeling prevails on the American side. The state of New York is greatly limited in power resources. It is yearning to develop the latent power of the St. Lawrence but refuses the navigation part of the project.

In the final analysis it appears that the Americans are very anxious to have the deeper waterway in spite of New York's opposition. The project is being made at the

present time a political football. It is being used by politicians to further their own ends rather than that of the country.

Canada has not as yet definitely made up her mind. For the above reasons she is as yet undecided. But here too, politics have entered. A fuller discussion with regard to political situation shall be given in the following chapter. But before we leave this chapter something should be said to explain why some people consider an all Canadian waterway as the best for our country.

It is apprehended that the navigation feature of the project is but a cloak for an attempt by our neighbours to grab the power possibilities of the St. Lawrence. How can they do this? It is explained by citing the different times that Canada got the worst of a bargain with the United States. In particular they refer to illegal action taken by Chicago.

The action that Canada has protested against is the diversion of Lake Michigan waters through the Chicago drainage canal. By treaty of 1909 that city was allowed on compassionate grounds to divert 4,167 feet per second for sanitary purposes, with the proviso that in the near future Chicago shall have built a new system of sewage disposal that shall not require such a diversion.

But the United States government under supposedly war

pressing conditions, after knowing that Chicago was secretly diverting almost 10,000 cubic feet per second, against the provisions of the international treaty, permitted that city to continue the diversion. Canada protested but was powerless against such powerful odds. For a time it was suspected and rightly so that Chicago was really trying to build a huge canal for the purpose of diverting traffic down the Mississippi from the West, as well as for generating power. If the American Government proved so faithless in the past, how can we trust it in such a gigantic task as the development of the St. Lawrence deep waterway, with its potential power resources. We know that the State of New York needs hydro power badly; we are aware that it is looking with longing eyes upon the St. Lawrence, not for its navigational possibilities but for its power. How are we to feel secure that in any international agreement with that great republic we shall not get the worse of a bargain. It is better ~~than~~ some way that we should take our time in this matter and build the waterway when we need it at our own expense without involving ourselves into international intricacies that may threaten Canada's existing sovereignty on the St. Lawrence.

CHAPTER 6INVESTIGATIONS ON THE ST. LAWRENCE
WATERWAY PROJECT

With regard to any new scheme, the onus of proof as to the desirability of adopting the new as contrasted to the old, remains with the advocates of the new project. The inauguration of a new plan of doing things if it does not involve new expenditures of capital but merely the alteration of one plan for another, demands that its benefits should in the aggregate not only exceed its disadvantages, but should in addition be superior to the existing structures. When expenditures of capital are involved the advocates of the new project must not only prove their case as to the alleged benefits that their scheme shall bestow upon Canada, but must also show that the confiscation of existing structures and the expenditures of additional capital involved are justified.

The only way to do this is to have impartial committees that are particularly fitted for the undertaking, to investigate on a scientific basis the subject under consideration.

This is the method followed by the governments of the United States and Canada. As we have seen, the alleged

advantages of the St. Lawrence waterway at their best are theoretical. Without a thorough study of the various phases of the project by competent investigators whatever we may say about the subject is to say the least uncertain. To get down to a more definite understanding of the subject, therefore, the governments of the two interested countries submitted the whole problem of the St. Lawrence waterway to the International Joint Waterways Commission for purposes of investigation and elucidation. An engineer from each country was also appointed to co-operate in the necessary surveys. It took two years for this investigating body to make its report.

The procedure of the board was to have various competent authorities on subjects relative to the proposal express their opinions, and give definite data if possible to the various questions asked, relative to the waterway. While the two engineers undertook the technical part of the investigation, they attempted to get a definite answer as to the feasibility of the undertaking and its cost.

A summary in brief of its findings and recommendations follow:

(1) Canada is not so enthusiastic over the scheme as United States, firstly because Canadians are preoccupied with alternative routes such as the Hudson Bay and the Georgian Bay Canal. (The latter has since been considered as impractical

by the Canadian government); secondly the advantages to be gained which are so apparent to the American are not so obvious to the Canadian because of our relatively unpopulous tributary area, which has a population one-tenth that of the American. Again, the Canadian government has spent \$25,000,000 on the Hudson Bay Railway and intends spending another \$17,000,000. The railway facilities of the country are ahead of their time and so the country feels that it has no immediate need as the United States has of the St. Lawrence. There is no railway congestion such as exists in the American area.

Taking the situation as it is today, the report of December of 1921 continues, with the existing depths of harbors and inland channels on the lakes, the evidence seems to show that a large proportion of vessels now operating on the high seas could be accommodated conveniently if the St. Lawrence river and canals permitted them to ascend.

Although a composite type of vessel to operate on ocean lake and river could be constructed, yet in the opinion of the commission, that is not an important factor as existing ocean vessels of the required draft could profitably operate on the lakes.

The commission agrees with the statement that where there is a productive interior, ships will proceed as far

inland as physically practicable and that the farther inland they can penetrate the greater will be the resulting economy. The more extensive the area benefited. Notable examples of rivers on which a considerable traffic has been developed by ocean going ships are the Amazon, Yangtze-Kiang, the Rhine, The Danube, the Columbia and Willamette, the Delaware, the lower Mississippi and the St. Lawrence river proper as far as ships can go.

Those who have given particular attention to the matter both in the United States and Canada are for the most part of the opinion that markets will be available to absorb all the power that can be developed on the international section of the St. Lawrence, within a reasonable period after the completion of the proposed works. High conservative estimates say will require about ten years.

As to the economic practicability, the commission finds that without considering the probability of new traffic created by the opening of a water route to the seaboard there exists today between the region economically tributary to the Great Lakes and overseas points as well as between the same region and the Atlantic and Pacific seaboard, a volume of outflowing and inbound trade that might reasonably be expected to seek this route sufficient to justify the expense involved in its improvement.

The commission finds that as between the United States

and Canadian sides of the tributary area, the former contributes very much the larger share of this foreign and coast-wise trade and will do so for some time. The benefits to be accrued will mainly accrue to the Americans but these will be more evenly divided in the future.

The region economically tributary to the Great Lakes with its limitless resources, its raw materials, within easy reach, its facilities for industrial expansion, can hardly fail to become a great factor in the world's markets.

It is easy to deduce from the above statements whether the commission is pro or con in this controversy. Apparently its findings in the main substantiate the arguments of the proponents. There were, however, certain difficulties which prevented the commission from giving a definite answer.

In the first place, in giving its answer, the commission based its findings upon the consensus of expert opinion which it had interviewed. It was therefore not able to give any precise advantages that the waterway would have but merely stated that it reasonably expected or believed so and so would happen. From its conclusions it looks as though the commission had met its superior.

In the second place the amount of technical help was insufficient to cope with so gigantic a problem adequately.

That the commission felt the same about the matter is

evident from the most important clause in its recommendations which states that owing to the magnitude of the problem, before any further action is taken by the respective governments these should appoint a new joint committee to reconsider the whole matter especially from the engineering view point.

What this commission had accomplished then was to manifest to us that the contentions of the proponents of the scheme when moderate may be considered as likely to happen; that in spite of what people may think, the undertaking is so gigantic and of such consequence as to involve a great deal more expert investigation than has as yet been given to it.

The principal² recommendation of the commission was accepted by both governments and as we have seen before, a joint board of engineers was created to further investigate the problem of a deep St. Lawrence waterway. Each government also instituted an advisory committee to advise it on matters pertaining to this important subject.

This Joint Board of Engineers consisting of three Canadians and an equal number of Americans was formed in 1924, given its final instruction in March 1925 and published its report in July of 1927.

As we have stated, the main object of the board was to formulate plans for the most efficient and economic method of constructing the waterway. It is not necessary

to say that before the board could serve its purpose it had to make its own separate studies, both as to power and navigation.

This board neither favoured nor opposed the waterway. It made its studies and investigations as a neutral body, offered the best plans it could and gave an estimate of what it thinks are reasonable benefits to expect. It gave its estimates on the cost of constructing the waterway and fulfilled all its expected functions. But one thing it did not do was to give its sanction to the waterway. The Board left the matter of deciding whether to build the waterway or not and when to build it with the respective governments.

Let us see what the joint board of engineers has contributed towards the solution of this momentous problem.

After considering the Great Lakes connecting channels division of the waterway, the board concentrated its studies in the improvements of the St. Lawrence river proper. The river was divided into five sections, namely, (1) the Thousand Islands section consisting of the deep reaches of the river sixty-seven miles long, from the foot of Lake Ontario to the first swift water at Chinanoy Point, three miles down stream from Prescott, Ont. In this section the problem is solely one of excavating channels for navigation purposes. No power could be developed here.

(2) The International Rapids section consisting of forty-eight miles of rapids and swift water between Chimney Point and Lake St. Francis. These two sections constitute the international division of the St. Lawrence river between Lake Ontario and Cornwall. It is in this latter section of the International division that over 2,000,000 horsepower will some time be developed. There is a drop in the river of about ninety-one feet between its limits. The so-called Williamsburg canals and the Cornwall canal are located as I have disclosed before in this section.

(3) The Lake St. Francis section which extends for twenty-six miles through that lake to its foot. Like the Thousand Island section, there is to be no power development here as none is available. The task here solely reduces itself to navigation improvements. The fall across the lake is six inches. The land surrounding it is particularly low. The section with the possible exception of the south-west corner is entirely in Canada. The remaining two sections are also entirely within the province of Quebec.

(4) The Soulanges section which consists of eighteen miles of rapids and shoal water from lake St. Francis to lake St. Louis in which there is an eighty-two foot drop in fourteen miles. The country is flat and low, particularly on the south side. The drop in this section consists of twenty feet at the Coteau Rapids in about three miles; thirty-two

feet at the Cedar Rapids in about two miles; seven feet at the Split Rock Rapids in about three feet; and twenty feet at the Cascades in about two miles. This section is capable of both power and navigation developments: (5) the Lachine sections which consist of lake St. Louis and the rapids and shoals from that lake to Montreal, a length of twenty-three miles. Through lake St. Louis, a distance of ten miles, there is a deep natural channel. From its foot to the head of the Lachine canal, a distance of three miles, the problem is solely one of dredging. Between the town of Lachine and Montreal there is a fall of forty-six feet, consisting of thirty-two feet between Lachine and Heron island of which twenty-four feet is in the Lachine rapids opposite the island, and ten feet between Laprairie basin and Montreal.

In the Soulanges and Lachine section, experts say there is 3,000,000 horsepower capable of development, all within Canadian territory.

In dealing with the Great Lakes division, the board proposes that in the St. Mary's river and at the Sault, all channels including locks be deepened to twenty-five feet. That would enable a boat of twenty-three foot draft to pass through. The width of the channels of 600 feet as they exist with few exceptions is ample. The cost of these improvements, the joint board of engineers estimates, will

be about \$21,000,000.

Between lakes Huron and Erie, the connecting channels where they already have not a twenty-five foot depth are to get it by dredging and the raising of compensating works. The length of the channel to be improved in the St. Clair river is ten miles, in St. Clair lake 15 miles; and in the Detroit river 16.5 miles. The cost for this work will be about \$22,700,000. At the outlet of lake Erie in the Niagara river the board proposes compensating works to raise the level of the lake by 8 inches at a cost of \$700,000.

The idea that various diversion effects could be offset by regulation works has been discarded by the board as being too costly. It has discovered that all the benefits could be secured by dredging and compensating works at half the cost; but these would not overcome the effects of illegal diversions.

The board has made its recommendations as regards navigation works throughout the system on a 25-foot depth permitting vessels of 23 feet draft to navigate freely. In addition, it has made supplementary estimates as to costs for 27 and 30 foot depths enabling vessels with 25 and 28 foot draft to sail safely through the channels. For the present, however, we shall concern ourselves with the proposals of the joint board on a 25-foot depth.

The prevailing idea appears to be that having obtained a uniform depth of 25 feet in all the restricted channels, it would be a relatively simple matter to deepen them further as future demands warrant. It is of notice that the American government intends expending \$24,000,000 deepening the channels between Lake Superior and Lake Erie irrespective of the St. Lawrence waterway project.

Between Lakes Erie and Ontario the new Welland Ship Canal which it is expected will be opened in 1930, will provide a depth of twenty-seven feet and possibly thirty.

Now we come upon the St. Lawrence river proper. From Kingston to Prescott some obstructions are met. The channels are quite wide and deep from Lake Ontario to about Clayton. Below the channels become very irregular and run through deep granite porcos. To get a practical navigation channel at a low cost we are forced on the American side for about two-thirds of the distance or about forty miles. Were there are two possible channels a very crooked one on the Canadian side that would cost about \$12,000,000 and a comparatively straight one on the United States side for about \$750,000 for a twenty-five foot depth. At the present time, the American channel is used exclusively by both countries for about 45 miles. The other third from Brockville, the cheapest place is on the Canadian side. It would cost ten times as much to place it on the American side whereas it would cost

about 4,500,000 if placed on our side. Concluding, we may say that the board promises putting the navigable channel between Lake Ontario and Prescott two thirds in the American and one third on the Canadian side if the most economical route is to be followed. This section at the present time is the most difficult to navigate. The current here is over two feet per second and the channel is about 350 feet wide. The board recommends that it be widened to 650 feet. One-third of the damage committed on the St. Lawrence is due to fogs in this section which cause the boats to run aground or collide. With a proper width and lighting system it is expected that these dangers will be greatly alleviated if not totally eradicated.

The next section, the one which raised the most controversy and has caused the disagreement between the two sections of the board, and the one of most importance because of its international complications is the International Rapids section. As we have seen, the Thousand Island section is also international but the solution to the problem it brings forth are relatively simple as compared to the rapids section.

As the board of engineers did not produce an unanimous recommendation as to how this section should be dealt with, it is wise to see what the International Joint Commission of 1920 through Messrs. Bowden and Mooten recommended and

wherein the recommendations of the Americans differ from those of our own representatives. These two gentlemen were the engineers appointed by the two governments to assist the commission in technical matters. The former was appointed by Canada and the latter by United States.

These two gentlemen recommended a single stage place whereby power was to be developed at the foot of Barnhart Island which is American territory. Firstly, they proposed a dam at Ogden Island just above Morrisburg, where there was to be a head of about 6 feet in summer and one foot in winter. A great deal of excavating was to be done between Galop Island and Ogden Island, a length of 15 miles. This excavation brought down the level of lake Ontario to that of the dam. But this was insufficient to the formation of an ice cover in winter to prevent the formation of frazil which would destroy the 7 feet of head every winter. In the Long Sault rapids they proposed a dam at the head of Long Sault Island with the mainland, then a dam from that island to Barnhart island where a power house was to be located.

Exception was taken to this plan by the joint board of engineers because of the loss of power that it involved. This board developed a scheme along similar lines but with a lower level higher and the loss in head at the upper dam less. This upper dam is to act as a sort of control dam at

the head of Galop island with the mainland and Adams island. This, along with a certain amount of excavation raised the level from Morrisburg or Oden island down to the dam at the Long Sault 7 feet above what was proposed by Messrs. Bowden and Hootten. This scheme necessitated a considerable length of embankment because the water from Chrysler island down to the head of Farnhart island was held higher than the level of the main road along the shore, even higher than the country in certain localities. This scheme would develop 78 feet of head at Farnhart island; it would flood out the upper end of the Cornwall canal and the Williamsburg canals except possibly the Galops Canal. This plan would enable a complete ice cover to form from the power houses at Farnhart island to the foot of Galop island. This would prevent the formation of frazil^{ice} and consequent loss of power in the winter. The control dam at Galop island will be so constructed as to regulate the velocity of the flow. This would be of importance when autumn storms tend to alter this velocity. The raising of the lower level of course meant that a smaller head was lost at Galop island than would have been the case under the 1920 boards plans. That meant that there was a loss of head up at this control dam in summer of about $1\frac{1}{2}$ feet and in winter of only $\frac{1}{2}$ foot, as against the loss of 7 feet proposed by the former committee.

The Canadian section of the board of 1924 accepted this

plan but the Americans disagreed. They maintained that this smaller loss of head in summer violated conservation principles, because it meant the perpetual loss of a certain amount of power. This power could be recovered at an extra cost of \$20,000,000 which the Canadian engineers consider as bold and extravagant. In addition, the saving of the loss of this head would mean that the banks for 15 miles on both sides would have to be raised an extra five feet. This would make the surrounding country insecure. Only the boldest type of engineering skill would undertake what the Americans proposed.

Then the Canadian group forsook this plan and developed the double stage scheme. By this scheme power is developed at two points. It has several advantages.

The upper plant can be built and its power marketed before construction on the lower plant is begun; in this manner profits will be earned before the whole undertaking is completed. This is considered to be very sound economically. But the American section would not agree to it. It was rejected on similar grounds as the first Canadian scheme.

There were several such schemes but the one that the Canadian engineers consider best is the Crysler island double stage scheme. In brief, it recommends that the Crysler island channel to the American mainland be improved and a control or regulative dam be put across whose gates will

remain open, only to be closed in case of emergency. At Cryder island a dam and power is proposed developing a head of about 25 feet in summer and never less than 19 feet in winter. The dams below would be the same as in the one stage plan, at the head of Long Sault island and between the foot of that island and Barnhart Island with a power plant at the latter. This international section is thus developed in two stages by this plan, a 25-foot head is first developed at Cryder island and a 60-foot head at Barnhart island. Both islands are American. At different points between Salond island and Barnhart island there will be channel enlargements.

The American plan provides for a control dam at Salond island. But unlike the Canadian plan it has no lock there, and their dam is not as complete as the former's plant. The purpose of the dams here is to throttle the flow in case anything happened below. They also provide for a big dam and power house at Barnhart island where they intend developing all the power. The canal that the American engineers propose at the side is considerably shorter, while the lock is to have a forty-foot lift. This was considered as being too bold, so the Canadian engineers recommend a long canal with a guard structure about the first lock to prevent accidents.

Here various arguments have arisen as to whether the

power houses and dams should be located at least one-half in Canada. This problem is not yet solved. The lower cost seems to favour the American side.

As far as navigation is concerned the channels on the south side of Galop island and past Cardinal will be improved. From Cardinal down to Chrysler island it always was open river navigation, a distance of 16 miles. Up to this point the boats will be navigating sometimes in American and other times in Canadian waters. These channels could be placed all in the Canadian side but it would be at a great expense. At Chrysler island a short canal and lock is recommended either on the American or Canadian side; there is practically no difference. This canal and lock would overcome the 28-foot head. At the Long Sault the canal recommended by our engineers is $6\frac{1}{2}$ miles long and with a maximum width of 300 feet, with two locks instead of one as proposed by the Americans. This canal is to be on the American side, while the existing Cornwall canal is to be left intact. It must be recalled, however, that under this plan the present canals above the Long Sault dams will be wiped out. If this canal were put on the Canadian side it would cost about \$2,500,000 more at least. The cost for the navigation works alone as proposed here would be about \$35,000,000, while the cost of combined power and

navigation will be about \$275,000,000.

Estimates were also made as to the cost of improving the navigation of this section alone without reference to power. The best scheme here provided is a side canal from above Galop island following the American shore for 15 miles to Warrington where a lock is put. In the river below a dam is built across the head of the Long Sault Rapids and a short canal to lake St. Francis. This scheme would cost \$75,000,000 but there would be a head of 63 feet developed at the Long Sault rapids that could be used for power purposes whenever required. This plan would leave the river between the Galop rapids and Morrisburg in the position it is at present. This is the best plan for a twenty-five foot navigation channel alone that the board has improvised out of a great many.

Some Canadians are averse to the location of these canals; they would prefer them on the north side, just as they are at present. The channels can be partly American and partly Canadian but it is felt that the canals should remain in Canada along with the dams.

One essential point to remember with regard to the development of the International rapids section is that the Americans are anxious to develop all its potential power immediately. Any scheme that does not provide for that would

be disagreeable to them.

The above schemes are just a sample of the many that have been promulgated. The Hydro Electric Commission has provided several; others on the American side have done similarly. But of all these the above are the most suitable to the Canadian section of the board. They have been given in brief, in order to better acquaint ourselves with the technical side of the project.

The third section or lake St. Francis section involves a small amount of excavation in a few places. It is a 50 mile stretch of water with a drop of half a foot. The cost is less than a billion dollars.

Next we come upon the Coulanres section which is about 18 miles in length with a drop of about 62 feet in 14 miles. This drop as has previously been stated, is divided in distinct parts. The preceding board of 1920 recommended a side canal for navigation between lake St. Francis and lake St. Louis, leaving the power development in this section for the future. The canal was to run from Henry Bay at the foot of lake St. Francis to Beloecheville at the head of lake St. Louis, it swings 3 miles south of Valleyfield into the bend and passes about in its middle, close to the St. Louis river. At the upper end there was to be a guard lock, and at the lower end there were two locks in flight, so that the whole drop was overcome at the entrance to Lake St. Louis. The canal, 15 miles long, was to be

excavated to a 300 foot width. The cost of this canal was estimated at \$33,000,000. The present board also made a similar recommendation at a similar cost. But in addition it also gave its recommendation on what it considered the best power and navigation scheme. The Boulaines section was divided up into three stages for power purposes. Each stage could be built in succession. With the first stage a dam across the river just 2 1/2 miles above the Cedar rapids was required with a power plant capable of generating 400,000 horsepower. About 10,000,000 is to be spent in channel enlargement on the south side of the Coteau rapids. A great deal of other preparatory work is recommended that need not concern us here. The second stage involves the diversion of 67,000 second feet overland from the pool above Cedarsville to the Ottawa and of lake St. Louis, thereby developing 500,000 horsepower at a 78 foot head just north of Cascade point. The third stage will not be constructed until all the power has been marketed. It consisted in building a dam across the river at Cascades island and a power house between Cascade island and Cascades point at which point a 54 foot head would be developed. By combining the power scheme with the navigation there is an apparent economy of about \$8,000,000. The board also recommended that the Federal government keep out of the power business in this section and build the canal for navigation alone unless an agreement

was made in advance for the leasing of power. The idea here is to build the side canal first and then to develop power as needed. This canal is similar to the one proposed by the Beauharnois Light and Power Company in the same territory. This canal would divert so much water that compensating works would have to be erected.

As it is known, the Rogers plant is located in this section generating considerable power. In the first two stages of the power scheme this plant would not be affected; but in the third stage which involves the building of a dam below the Rogers plant will flood it out. Therefore, in the last stage of this sectional development, the existing plant must be scrapped. This seems to be an unfortunate circumstance as the cost of the Rogers plant is estimated at about \$25,000,000. This destruction will only take place when the third stage of power development occurs. The navigation works do not affect the plant at all. The Government can construct such works quite cheaply no matter how the river is improved for power.

Finally, we come upon the Iachine Rapids section between Lake St. Louis and Montreal. The drop here is 40 feet and it is overcome by the Iachine canal. The cost of developing this section for navigation alone is estimated at \$13,000,000. The improvement of this section for power is very difficult

and costly according to the joint engineering board. They recommend the building of a canal without the development of power. Power can be developed later as it is required. The idea of the board is to construct a submarine channel for a number of miles from the outlet of lake St. Louis to Lachine. Below Lachine down to about half a mile below the C. P. R. bridge the plan is to excavate the canal along the river and bring it to a higher level. The canal then stretches overland to Montreal. Three locks, one below Victoria bridge, the other at Man's island and the third near Jordan. The canal will pass close to the river. For the sake of future power development. It is recommended that the level of lake St. Louis be raised 5 feet by a dam across the crest of the Lachine rapids.

It is hoped that the brief description of detail given above will give us a better understanding of the technical side of the project. From all possible engineering viewpoints the board has taken great pains to see that the waterway is a complete feasibility. There are many things which I have not mentioned; among these is the problem of eliminating the formation of frazil which hinders power development. At certain points it is thought that the stray prevailing winds will damage the boats in the canals. The solution to these problems is in the possession of the board. It has plans of its own as well as those of outside interested

bodies. It certainly is now lacking in severity. I think it can be safely said that for almost any technical difficulty that may arise, the board and the engineering profession in general may be counted upon to give a solution that shall be economically acceptable. In fact there are so many plans that may be acceptable that it is difficult to decide on any particular one unanimously. For example, the Hydro Electric Commission has offered several plans which it considers the best, the American section has done similarly and finally the Canadian section of the board has offered its plans as well as others. As far as engineering ingenuity is called upon to overcome nature's obstacles, we may rest assured that they can be. It is the economic benefits that people are rather uncertain about.

The minimum depth of the waterway according to the original plans is to be 25 feet. But opinion has in the meantime changed. After more or less exhaustive studies it has been wondered whether a 27 foot depth and possibly a 30 foot depth would not be more appropriate to take care of the future needs of the traffic. We have seen how the history of the waterway has been one of continual progress. It is essential therefore if we are going to take care of the future properly to make forecasts of posterity's need for a still deeper waterway. Even at the present time it is not so certain that a 30 foot waterway would not be

better than the 25 foot one if economic expenditure justifies it. The board has therefore given estimates not only for a 25 foot depth but also for a 27 and 33 foot depths.

We have observed that the Canadian section of the board if not the whole board plan to exploit the power possibilities of the St. Lawrence river by stages. This is done in recognition of the fact that Canada cannot consume all the power that can be made available. The board, therefore, has given estimates as to the cost of constructing the navigation works alone and also the simultaneous development of 1,000,000 horsepower on the St. Lawrence river in the international section, half of which belongs to Canada.

To acquire a 25 foot depth in the Great Lakes connecting channels from Lake Superior to Lake Erie, the cost is estimated at approximately \$50,000,000. It includes compensating works, dredging, widening improvements of locks, etc.

The new Welland canal for the same depth will ultimately cost \$114,000,000. The total cost for lake improvements therefor excluding the St. Lawrence river proper is about \$165,000,000. The interest on this sum at 5% would be about \$30,000,000 during period of construction.

Assuming a 25 foot depth throughout the following sections we find that the improvement of the Thousand Island section would require about \$1,100,000 and the interest \$55,000; the international rapids section for navigation

alone would cost \$79,000,000, and interest \$10,000,000 during the period of construction; the St. Francis section costs \$1,000,000 and interest \$30,000; the Coulongnes section for navigation alone, the cost is \$34,000,000 with interest at \$3,000,000; and finally the Lachine section would cost \$82,000,000 for navigation alone with interest at \$7,000,000 during the period of construction. This totals in costs for the St. Lawrence river alone approximately in round numbers \$168,000,000. The total interest charges for the same works during the period of construction will be approximately \$20,000,000. The total cost therefore for navigation improvement of the St. Lawrence river will amount to \$188,000,000 approximately. Adding to this the lake connection channel improvements cost of \$50,000,000 we have a total of \$238,000,000 that must be expended if we put the waterway project into execution. This cost we must reiterate does not include any power development.

If we include the 1,900,000 horsepower as proposed by the board, we must add to the cost about \$195,000,000 and extra interest charges of about \$65,000,000 during construction period. This brings our grand total to \$494,000,000 for navigation works and the development of 1,900,000 horsepower, excluding the cost of the New Welland Ship Canal.

From the above statistics then we may conclude that if we desire to have the 25 foot waterway from the head of the lakes to Montreal with a simultaneous development of 1,900,000 horsepower in the international section, there must be expended in addition to what has already been spent, \$494,000,000.

If we wish to have the whole system deepened to 27 feet we must spend an additional \$50,000,000; if we desire a 30 foot depth we must spend a still further sum of \$70,000,000 approximately. Should we desire than a 30 foot depth instead of the proposed 25, there must be spent an additional \$120,000,000 giving us a grand total cost for that depth of \$614,000,000; we must remember that this does not include the \$115,000,000 already being expended on the new Welland Ship Canal.

Let us see what the annual charges for a proposed 25 foot waterway with 1,900,000 horse-power are. Annual interest at 5% will be on the \$494,000,000, \$25,000,000. Operation and maintenance expense will be in round numbers \$1,000,000 for the navigation works and \$1,500,000 for power. Depreciation on a similar basis will amount to about \$2,500,000 for power and navigation works. This gives us total charges of \$28,000,000 per annum. Mr. McLachlan in his estimates has assumed that the upper lake channels will be improved free of charge to the St. Lawrence project by the United States.

He apparently bases his assumption on the fact that the American Government has been maintaining the structures in the past and since it has already led itself to spend an additional 24,000,000 for further improvements there, the United States may reasonably be expected to assume all future charges in these channels as they have been doing in the past. With such an assumption he finds the annual charges of the St. Lawrence project proper to amount to \$26,650,000. The annual charges on the Welland ship canal he estimates at \$7,400,000, its benefits at \$1,000,000.

Reflecting that assumption the total charges of the project would be in round numbers \$38,000,000.

The annual benefits as given by Mr. McLachlan and as modified by me in round numbers are from power \$30,000,000 per annum; from transportation as given by Mr. McLachlan for Canada \$11,000,000, for the United States \$22,000,000; making a grand total of \$63,000,000. If we exclude the saving from power we have an estimated saving from transportation of \$33,000,000; similarly excluding the annual charges for power the navigation charges amount to: interest \$12,000,000 at 5% per annum on \$238,000,000; operation and maintenance \$1,000,000; depreciation \$750,000; this gives us total navigation charges of \$13,750,000 per annum. If we add to this the charges of the Welland ship Canal the grand total charges amount to \$31,000,000 approximately speaking.

Mr. McLachlan's estimates have been modified so as to give the statistics in round numbers. This change of itself alters very slightly his statistics. In the joint engineering board's report the cost of the navigation works in the international rapids section is given as \$79,000,000. Mr. McLachlan has given a figure of \$34,350,000. But this figure is for cost of navigation works alone when built in conjunction with the power works. Should no power be developed at all, then the cost of the navigation works is given as \$79,000,000; The calculations as given above have been based on this. Again, the cost of the improvements in the upper lakes section have been taken into consideration in the above calculations.

The charges therefore as given above are about \$3,000,000 more than those given by Mr. McLachlan for power and navigation and for navigation alone about \$5,000,000 per annum.

However, even at the higher figures, the waterway still stands in favourable light. The estimated annual benefits exceed by far the annual charges. Should, however, a 27 foot or 30 foot waterway be planned, the costs as we have seen will increase considerably. The operating and maintenance charges for the navigation works are not very much greater for a large system than for a smaller one. But the fixed

charges will be so much greater as to cut very deeply into the net estimated benefits of the waterway. The average annual maintenance and operation costs of the present navigation system from Lake Superior to Montreal are estimated at about \$2,000,000 and for the proposed works at \$2,700,000.

From what has been said it is apparent that the joint engineering board, though it does not openly testify in favour of the waterway as Mr. Lefevre, one of the members, tells us, yet by its very actions, recommendations, tacidly implies to say the least that it favours the project. This board was largely instrumental in convincing us of the feasibility of the route. In addition it has adopted in a modified form some of the plans of its predecessors. The economic investigations and conclusions of the former joint commission as regards the waterway have apparently been adopted by this engineering board. It is axiomatic therefore to say the least that this board has automatically and by implication given its sanction to the scheme. Mr. Lefevre's contention that the board has not proclaimed itself in favour, may be superficially true, yet from what has been said above one cannot help but conclude to the contrary.

CHAPTER 7.CURRENT EVENTSFOLLOWINGTHE REPORT OF THE JOINTBOARD OF ENGINEERS

On April 13, 1927, within a short time after the results of the joint engineering estimations were made known, the American government through the secretary of state, the Honourable Frank B. Heller, commenced correspondence with our government, through the Honourable Vincent Massey, Minister for the Dominion.

In its first letter, the United States briefly outlined the importance of the waterway to both countries, and after admitting that it concurred with the recommendations of the American Advisory Committee and asking for the Canadian government's attitude, expressed its desire to enter into negotiations with a view to an appropriate solution to the problem.

On July 12 of the same year the following reply was sent to the American government. "The report of the Joint Board of Engineers signed on November 16th, 1926, while unanimous in many respects, indicated differences of opinion on important phases of the development proposed. It

is understood that in the appendices to the report, which are in preparation, certain further alternative schemes will be presented which will be of essential nature in arriving at a conclusion.

The National Advisory Committee appointed to report on the economic and general aspects of the St. Lawrence Waterway question will not be in a position to make a final report until all the findings of the Joint Engineering Board, including the appendices are available."

Upon receipt of the report of the National Advisory Committee, the Canadian Government expressed its desire to enter into further discussion with the United States Government.

It has been mentioned in the preceding chapter that the Board concerning the possibility of a 40 or 33 foot waterway being preferred to the proposed 25 foot one, made additional estimates as to the cost of these two alternative depths. The report of the National Advisory Committee which came out in January 11, 1938, actually recommended that proper allowance should be made for future requirements and that the navigable depth of the reaches and connecting channels should not be restricted to 25 feet as originally contemplated.

Like the majority of the Canadian section of the Board

and of the American Advisory Committee, the Canadian Advisory Committee is of the opinion that a 17 foot minimum channel should be provided accommodating vessels of 25 foot draft in addition to 20 foot depth for the permanent structures.

The advisory committee likewise agrees with the joint engineering board that the project is feasible. But whether it, as yet, is desirable or not the Committee has been unable to form any conclusions.

The Committee finds that should Canada be required to finance the whole undertaking or even assume one-half the present financial obligations involved in the project as a whole, it would unhesitatingly recommend that such action be deferred until such time as will enable Canada to recover from the heavy financial burdens imposed by the war, by our railway obligations and by the necessity since the war ended to find the large sums required for public works. Even the outlay for the domestic section would be too heavy a burden at present.

The Committee opines, however, that an arrangement could be made whereby at little public expense the undertaking might be completed. It is considered by the above body as most desirable that the initial development of the waterway be undertaken in the essentially domestic section of the river lying within the Province of Quebec. The advisory board further believes that within a reasonable time the

resultant power would be economically absorbed and that private and public agencies could be willing to finance the entire work, including the necessary canalization in return for the right to develop power.

It must here be recalled that these recommendations are partly at variance with the engineering board's recommendations. To develop power in the Lachine section would involve great expense according to the board's report and it should only be undertaken as the last leg in the development of power in the St. Lawrence. It would be considered uneconomical therefore to expect private interests or anybody to develop power at a great expense when it could be developed considerably cheaper either in the Outaouais or International section. The advisory committee's recommendation that the initial development be made in the domestic section is therefore applicable only in the Outaouais section.

The committee considers that the International section presents features of greater complexity. It points out that the disagreement between the Canadian and American factions of the joint engineering board must be satisfactorily settled. It believes also that proposals which would oblige Canadian communities on the St. Lawrence to live behind embankments at a lower level than the waterway should be given consideration before any action is taken. For a

number of reasons therefore the purely engineer features of the international section must be further considered, in which connection it is felt the Ontario Government should be asked to nominate one or more engineers to co-operate with the United States and Canadian engineers in a further study of the problem.

With regard to the financial side the advisory board has recommended that the United States assume the total cost of the international and upper lake channels sections, while Canada assume the cost of the purely national sections including the Welland Ship Canal. In view of what Canada has spent on the waterway in the past, should the United States assume the obligation of the international and upper lakes sections, the preponderance of outlay will have been with Canada.

The committee further believes that while navigation structures lying within one country or the other can on completion be most advantageously maintained and operated by the country in which such works are situated, yet the control and supervision of the works during construction and of the operation and maintenance of all dams, embankments, power-houses, superstructures, water passages, etc. in the international section should be designed, constructed and operated by an international commission appointed for the purpose.

Since power is to be developed in the International section first, it is recommended that Ontario and Quebec should form an understanding to enable the former province to utilize some of this power in its eastern counties.

The committee is in complete accord with the prevailing thought that export of power should be permitted.

In the event of a new treaty being negotiated with regard to the waterway, it is recommended that the United States should not be given any greater rights than they already possess in existing treaties.

The Canadian government having the report of the advisory committee, at once continued corresponding with the United States. In a letter sent January 31, 1928, the findings of the Canadian Advisory Board were explained to the American government. In addition, certain inherent differences between Canadian and American existing transportation conditions were made manifest. Though it was acknowledged that Canada would benefit from the deeper waterway, it was observed that the United States would benefit to a much greater extent. It was further pointed out that the restrictions on the importation of Canadian farm products that have been imposed by the United States in recent years, to benefit the American farmer, as well as the restriction upon Maritime fisheries products are

factors which have contributed to make Canadian public opinion less crystallized in favour of the project than the United States.

In this letter it was emphasized that public opinion is adverse to the exportation of Canadian power whether from the national or international sections.

It was further demonstrated that in the development of power the relatively limited capacity of the Canadian market must be considered; that in any arrangement it was most important that the development of power on the Canadian side should not exceed the absorption powers of the Canadian market.

In fine, the Canadian Advisory Committee's view with which the Canadian Government concurred was disclosed to the American Government, along with a balance sheet showing how the costs of the project as advocated by the above committee may be allocated between the two countries.

In support of the Canadian view the following statement was submitted by the committee, based on expenditures by both countries in the present through waterway and on the estimated cost of the project with a 21 foot navigation, a new lock at the Soo on the American side of similar depth, and of such power as is incidental to navigation.

Here we come upon an important difference between the

joint board and this committee. The former recommended that all navigation works be commenced simultaneously, or at such intervals as would guarantee their simultaneous completion; along with the navigation works the board recommended that the 2,000,000 horsepower in the international section be developed; while the power in the national section can be deferred and developed as future needs demand.

The advisory committee on the contrary maintains a preference for the development of the national section first with approximately 1,000,000 horsepower and the development of the international section later after all its complications have been settled along with as much of its available power as the Canadian market is capable of consuming. Its statement is:

CANADA

Present Works

St. Lawrence Ship Channel	100,000,000	
St. Lawrence and Welland Canals	50,000,000	
Lock at Sault Ste. Marie, Ont.	<u>5,530,000</u>	
		\$65,530,000

Proposed Works

Welland Ship Canal	115,000,000	
Wholly Canadian Section St. Lawrence		
shipway, 27 ft. navigation and		
development of 949,700 h.p.	<u>199,670,000</u>	
		\$315,270,000

Total for Canada \$400,830,000

UNITED STATES

Present Works

Dredging St. Clair and Detroit Rivers	17,936,000	
Locks at Sault Ste. Marie, Michigan	<u>26,300,000</u>	
		\$44,236,000

Proposed Works

International Section St. Lawrence shipway 27 ft. navigation and initial development of 597,000 h.p.	\$182,187,000	
To complete development - additional power 1,002,000 h.p.	92,000,000	
Upper lake channels to 27 ft.	<u>63,000,000</u>	\$339,547,000
Total for United States		\$182,182,000

The St. Lawrence project involves along with its other complexities constitutional difficulties. The provinces of Ontario and Quebec question the right of the federal government to water powers made available by federal works for the improvement of navigation. Conferences were held between provincial and federal representatives with a view to settling this controversy. But it was found impossible to reach any general conclusion. As a result the matter was referred to the supreme court of Canada in April 1928.

All these facts along with the report of the advisory committee were disclosed to the American government in the last mentioned letter. In March 12, 1928 the Hon. Frank B. Kellogg replying in kind the above views replied on behalf of the American government that while the United States government was not in complete accord with our representations as to relative benefits and ultimate cost to the two countries, it remained an excellent basis of negotiation and proposed a proposal along the general lines suggested in the latter.

He also felt that the United States ought to have its share of the international section power without waiting for Canada to be capable of consuming her share. Here then is a difficulty if we are to develop power in the national section first then our need for the power in the international section becomes more remote; the project itself then in so far as power is concerned becomes further delayed.

Mr. Kellogg declares himself to be in general accord with the general trend of the note in general. But, he is inclined to the view that the existing works on the St. Lawrence have served their purpose and paid ample dividends and in so far as they are useless to the new project they must not be included in the costs. The United States, according to the above reply is favourable to have the channels and canals with a minimum depth of 27 feet and at the same time to provide for a 50 foot depth to take care of future requirements. It is noteworthy that everything is general and nothing in the particular.

The United States fully recognizes Canada's right to the ownership and use of the Canadian share of the power which may be developed in the international and national sections. It is further recognized that the disposition of our power is purely a domestic question and that this share is an inherent attribute to Canadian sovereignty. The United States also accepts without reservation the principles as to

operation and control, as given in the Canadian letter.

But the latter concludes that the project in definite could be accomplished both countries should proceed with the appointment of commissioners to discuss jointly the problems presented in the note and various others that may arise during the project. In fine, the American attitude as expressed in this reply is that of a recognition of the magnitude of the problem, that there is need for further investigation, and of a desire to negotiate with Canada in the hope of reaching a satisfactory solution, at as early a date as possible.

A counter reply was sent to this last American letter on April 5, 1927, in which the contents of the United States reply were recapitulated and further emphasized the fact that it is essential in any plan economically feasible from the Canadian view, that the development of power to be utilized in Canada should not outrun the capacity of our market to absorb and consequently to meet the proportion of the costs of the project fairly chargeable to power. It was further demonstrated that preliminary to any comparison of costs or decision as to the order of construction or division of costs, it is essential that the divergent views of the two engineering sections of the joint engineering board be reconciled. It was further reiterated as in previous Canadian letters that in so far as Canada was concerned were

are important constitutional matters to be settled before we can take any definite stand.

The reply concluded by stating that the subject is constitutional matter which had already been referred to the Supreme Court of Canada, was settled, Canada would be in a better position to inform the American Government further of its views. The view of the United States, the Canadian note added was sufficiently clear to enable it to discuss the problem with the province directly concerned.

The Honorable Frank R. McMillan replied two days later agreeing with the proposal contained in the last Canadian letter and expressed the willingness of the American Government and section of the Engineering Board to co-operate with the Canadian sections, just as soon as we desired. He observed however, that the entire subject of treaty, ratification need not be postponed until the termination of these discussions and that it might be desirable for the negotiations to go on concurrently with the examinations of the engineer and other domestic difficulties.

In less than a year since this letter was written the Supreme Court of Canada has dealt with this constitutional matter but has found it impossible to give a definite answer. The matter was therefore again left to the Federal Government and the two provinces to settle. At the present time,

therefore this important matter is not yet all settled. The consensus of public opinion seems to be however, that navigation development in these waters is entirely a Federal matter while power development is within the jurisdiction of the provinces.

Certain members of the Advisory Board did not agree with all the recommendations of the majority. Their primary differences of opinion concerned the financial features of the undertaking. They claimed since the tributary areas of the two countries is in the ratio of approximately 8 to 1, it is evident that the United States will benefit enormously from the undertaking, especially when the relative wealth of the two areas is considered.

They suggested, therefore, that a different basis for the negotiations between the two countries should be formulated. The following plan is offered for a 27 foot channel.

Or at Lakes channels	\$ 65,100,000
Welland Canal	115,600,000
Thousand Island section	1,500,000
International Rapids section	
Crysler Island - Two stage development	
666,000 h.p. at upper stage and navigation	180,625,000
Soulanges Section - First stage 1,800,000 h.p.	105,000,000
Lachine Section	55,800,000
Channel enlargements below Montreal	<u>31,000,000</u>
Total Estimated Cost	\$557,236,000

One should observe that both estimates of the advisory committee have apparently neglected to consider interest charges during construction.

The above estimated cost of about \$269,000,000 would provide 27 ft. navigation from the Great Lakes to the sea and incidentally, through the improvements to navigation, there would become available 566,000 horsepower in the International section and 382,000 in the Soulanges section. A generous contribution by Canada of this expenditure would be about one-third, of \$186,000,000; while the United States contributed the two-thirds or \$374,000,000. But since Canada has already expended \$30,000,000 on the Welland Ship canal and another \$22,000,000 on improvements below Montreal, there should be deducted, leaving for Canada to spend an additional \$68,000,000. For this additional expenditure, Canada would receive 282,000 horsepower from the international section and 372,000 from the Soulanges section or a total of 654,000 horsepower fully developed and installed.

It will be noticed that by this financial plan, the United States is asked to contribute for two-thirds of the expenditure involved in the development of power in the Soulanges section from which they are not likely to benefit directly. This section could be constructed for navigation purposes at a cost of about \$40,000,000; the balance of the

\$105,000,000 then is for power. Why should the United States be asked to contribute towards the cost of structures that are not likely to benefit them? The minority of the advisory board claim that this is a fair allocation of expenditures because Canada is undertaking one-third of the cost of improvements in the Upper Lakes whose tonnage is largely American; that a just basis of contribution of expenses in this section based on the tonnage utilizing it would be about 1 for Canada to 15 for the United States. Again, it is likely that Canada will have to assume the cost of operating the proposed St. Lawrence canals. Under such circumstances it does not seem unreasonable to this minority to expect the United States to pay on the above basis.

It is hardly necessary to state that the United States do not see the matter in that light, especially when their keen desire to utilize all of their share of the available power in international section.

The minority of the advisory board, however, provide for this. Should the American republic desire to utilize its additional share of 756,000 horsepower in the international section, they may do so, after an understanding with Canada, by undertaking to build at their own expense all the dams, canals and substructures necessary. When and as Canada is ready to utilize its share of the power in whole or in part,

it will then build its own power house etc. at its own expense and will then reimburse the United States of its share of the cost of the dams, etc. without interest, in the proportion that the successive installations made by Canada bear to the total power capacity.

Additional provision is made for the development of power in the national section by consecutive stages. In the Soulanges section at the second stage, 500,000 horsepower would be provided at \$7,000,000; at the third stage 174,000 at \$64,000,000. In the Lachine section at the first stage 311,000 horsepower would be developed at a cost of \$81,247,000; and at the second stage 422,000 at a cost of \$11,000,000.

Thus under this plan, excluding the 110,000,000 already spent on the Welland Ship canal and below Montreal, the ultimate expenditure or cost of the water power would be about \$750,000,000. This, as I have said does not appear to include interest during cost of construction. Basing this interest on Mr. McLachlan's estimate, this would add roughly another \$133,000,000. The complete ultimate cost of the project would therefore be approximately \$875,000,000; or assuming an ultimate 40 foot depth about \$900,000,000. Out of this vast expenditure the cost of the navigation structures from the head of the lakes to the

ocean would only involve an additional expenditure of about \$200,000,000. If we add the amounts already expended by Canada in the Welland Ship Canal and on improvements below Montreal, the total navigation cost would be about \$320,000,000; while the total ultimate cost including all power developments would pass the billion dollar mark.

Little wonder then that so much has been said about this deeper waterway and little accomplished. It is a problem which shall occupy the minds of investigating authorities for some time to come.

We must not, however, think that past investigations have accomplished nothing. On the contrary they have brought a great many facts to light that will enable the governments of the two countries to act with greater confidence in all matters pertaining to the waterway. There are a great many points to be cleared up but there are others sufficiently solved to enable our government to take a decisive step forward. The granting of the Beaulieu charter for instance depended primarily on the recommendation of the two boards, particularly the advisory committee.

This committee recommended as I have disclosed above that it would be advisable to permit the development of power by private agencies in the purely national sections and in exchange to require them to build and maintain navigation

structures at their own expense suitable to the desires of the government.

The permission given the Beauharnois interests to build and maintain a 20 foot canal and to develop about 500,000 horsepower in the LaSalle section, is looked upon rather unfavourably by the American proponents.

At the present time the deep waterway project has become a political football in the United States and it is threatened to become so in Canada.

Striking changes in viewpoints appear to be going on in both Canada and the United States. In the latter country New England seems to be joining the ranks of the proponents while in our country Ontario apparently is becoming anxious.

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